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MARCH 1, 1997
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The 1998
CIO Enterprise Value Awards

Honoring Business Achievement Through The Innovative Use of Information Technology

APPLICATION FOLLOWS PAGE 26

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Begins On Page 34

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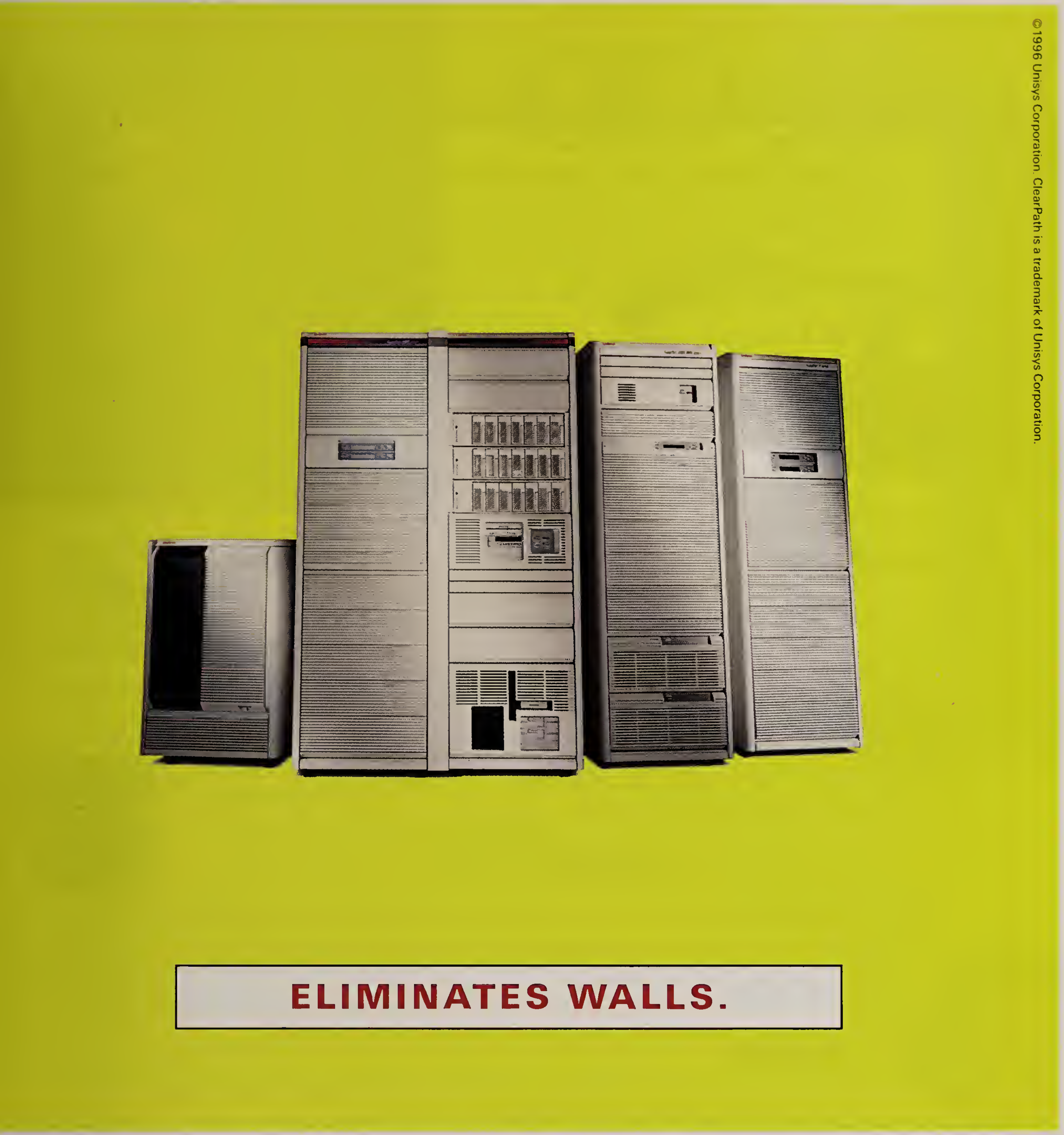

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software reuse

By *Miryam Williamson*

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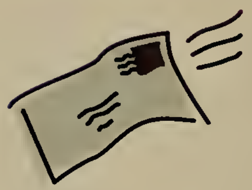

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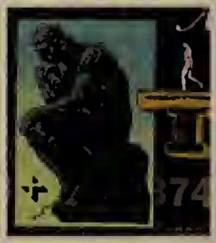

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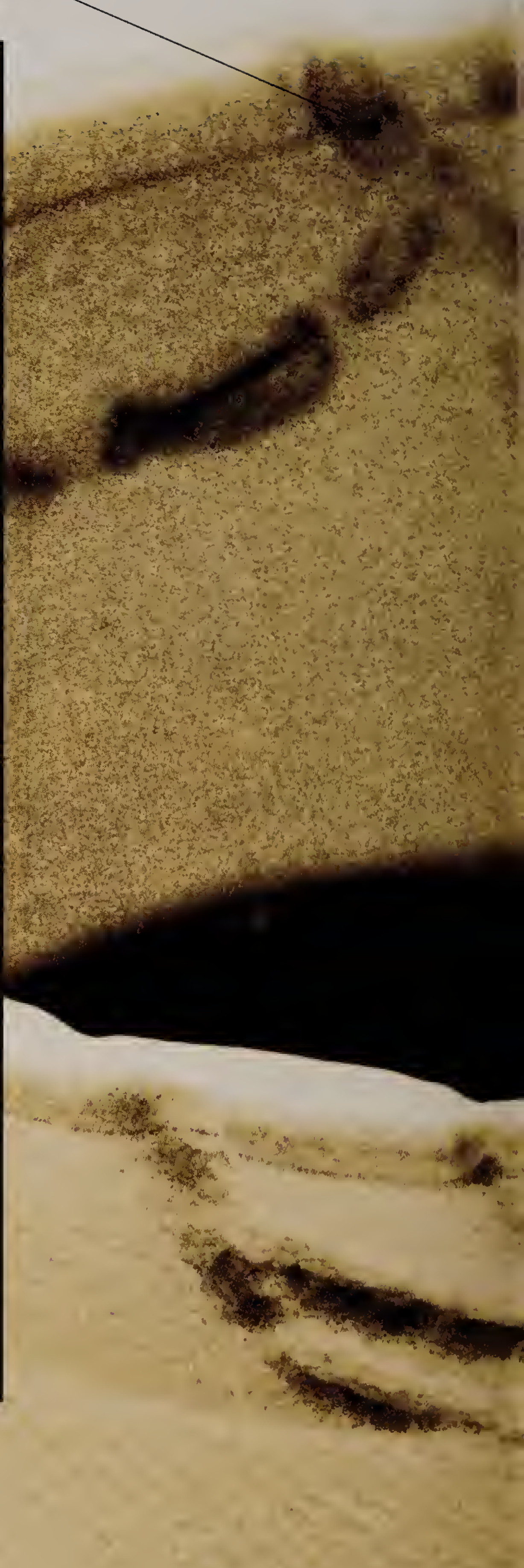

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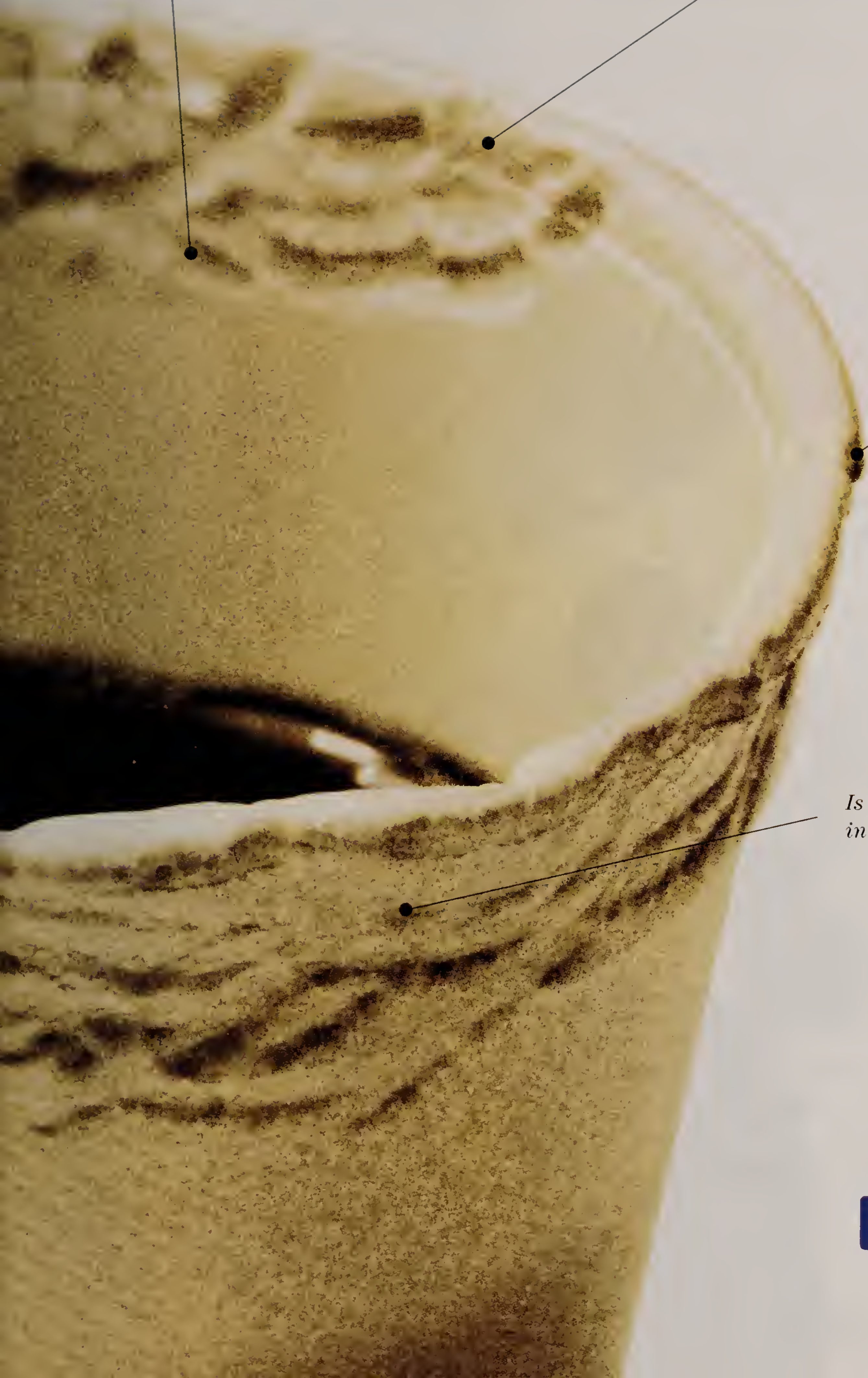

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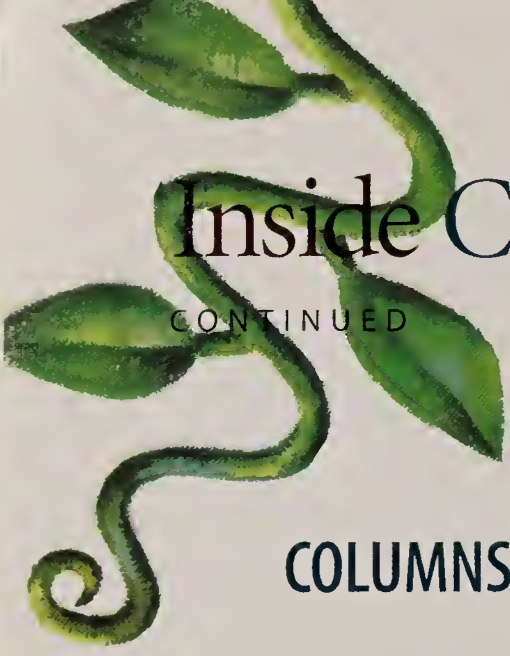

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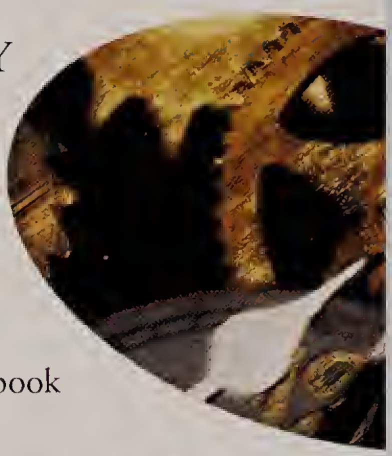

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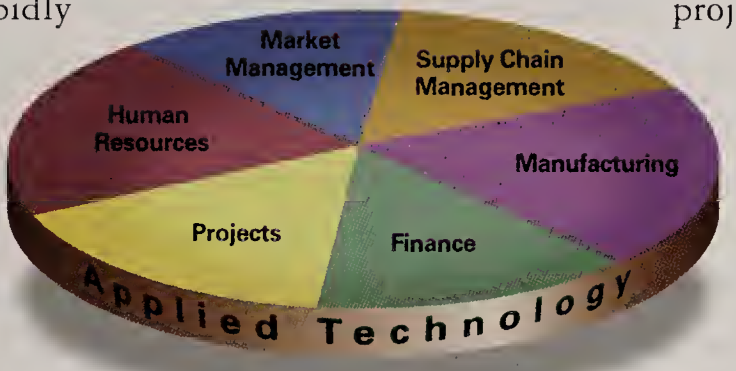

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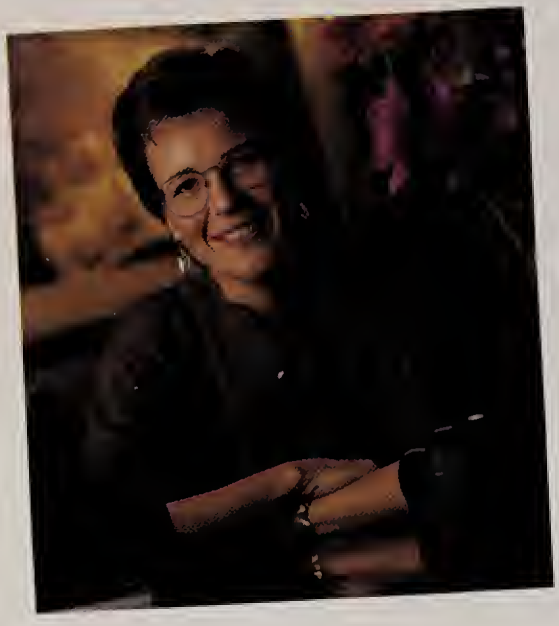
LETTER FROM THE EDITOR, READER FEEDBACK AND HOW TO REACH US

Those of you who have been reading *CIO* since its early days will no doubt be as amazed as I am that we are nearing our 10th anniversary. (I sure hope the next 10 years don't go as fast—but they'll probably go faster.) We're planning some special coverage and events to celebrate this milestone, and we would appreciate your input as to what's interesting about the decade gone by, the current state of IT and the CIO position, and what the future is likely to bring.



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We'd also like to know more about you, our readers. What follow are some questions we'll be asking you in the coming months. Simply send your responses to me in an e-mail (*lundberg@cio.com*). We'll begin publishing them either in the magazine or on our Web site in May and continue throughout the rest of the year.

Where were you 10 years ago, and what were you doing? If you were at the same company as you are now (and especially if you were in your current position), what's the secret to your longevity? If you were elsewhere, how many companies have you worked for? How many jobs have you held? How long have you been reading *CIO*? What's the biggest change IT has made in your company in the last decade? What has been your greatest moment as an IS professional in that time frame? If you could go back in time to 1987 with the knowledge you have today, what one thing would you do differently? Fast forward 10 years: Where do you expect to be, and what will you be doing?

From the conversations I've had with CIOs over the past few years, I know there are some great stories out there. We'd love to hear yours.

Abbie Lundberg

lundberg@cio.com

FROM OUR READERS

EDI EXCHANGES

I enjoyed your timely article on EDI and the Internet ["The Once and Future EDI," Dec. 15, 1996/Jan. 1, 1997].

EDI's raison d'être is to enable different business entities to have a vendor- and system-independent way of communicating business information to each other. The consultants who talk about new EDI standards for electronic commerce are mixing apples and oranges—there's no need for a company to put EDI transactions between its order-entry Web screen and its order-management system. (But if the company has outsourced the electronic order-entry process, it may make a lot of sense for the outsourcer to send the results of the Web-based transactions back to the vendor via EDI!)

Secondly, as sexy as Web servers and

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browsers may be, Web servers are just applications that run on the Internet. The bang for the buck, as far as EDI is concerned, will come from using the Internet to set up VPNs (virtual private networks), i.e., point-to-point contact between different companies' business systems. That will enable them to exchange data on a demand basis—make a connection, transfer the data, then break the connection. No fuss about modem speeds, asynchronous versus bisynchronous protocols, busy telephone lines and all the other communications problems that drive businesses to use expensive VANs.

The first major proposed standard that will "Internet enable" EDI appeared recently and is already gaining steam. It's called PPTP, or Point-to-Point Tunneling Protocol. Jointly developed by Microsoft and U.S. Robotics and now co-sponsored by Cisco, PPTP lets computer systems set up secure, encrypted connections between their systems. To the systems in question, it looks just like one more communications protocol. PPTP is already running on Windows NT 4.0 servers and workstations, and it should be available on Windows 95 PCs early this year.

Electronic COMMERCE

The once and future EDI

Hopefully, the future will belong less to expensive and proprietary applications and more to VPN-enabled standard EDI applications. Just as my company's current EDI system dials up another company to exchange data, our future systems will initiate a PPTP link over the Internet, transfer the data and then break the link.

Roy Wilsker
Manager, Technology Planning
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I just recently implemented EDI in our company because our federal government customers are making a huge push toward EDI. How will this affect the future of EDI, considering that the government is an enormous "customer base"? Here in California, California Multiple Awards Schedule is watching the Feds to see what they do so that they can model their EDI accordingly. Do you think the Feds and the states will push more toward the Internet or stick with their current plan of straight EDI?

Jason Painter
EDI Manager
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Lynda Radosevich's article on EDI was narrowly focused and largely inaccurate. I realize that products and services in New York are more expensive than in other parts of the country, but Radosevich's statement that "VANs typically charge $25 to transmit 1,000 characters" is ludicrous. I don't know which "experts" she consulted, but my years of electronic commerce experience with a $1.5 billion distributor tell me that typical VAN charges are about 20 cents per kilo-character (KC), with off-peak and high-volume discounts bringing that figure down by 20 percent or more. Granted, these rates are excessive considering where technology is today, but they are highly competitive considering the cost of paper processing. As for Steve Botts's statement that some smaller companies using traditional VAN services "spend $40,000 to $60,000 per month just sending regular [purchase orders] and invoices," if these numbers are correct, using an accurate rate of 20 cents per KC and assuming an average document size of 2K (the statistical average for a sales order or invoice at my company), we're

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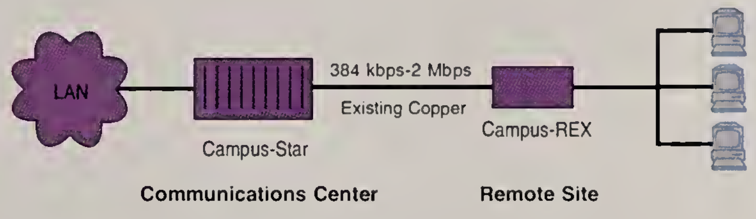

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talking about 125,000 EDI purchase orders and invoices per month to add up to $50,000 in charges. Anyone who has been doing EDI for any length of time will tell you that this is the activity of a very large, EDI-intensive company.

What was even more comical than the various exaggerations was the lack of any mention of integration when discussing EC architectures and solutions. Radosevich and several Web-based EC solution pundits are only looking at the home consumer side of the EC equation. Imagine the environment in which a multibillion-dollar corporation with tens of thousands of employees does its purchasing via Web browsers. Those companies often have bases of hundreds or even thousands of active vendors. Each of them would have its own Web site with its own form for order entry. That would mean hundreds of Web sites to connect to, hundreds of different order-entry procedures and varying functionality.

The electric handshake

Until the client side of Web-based EC software interacts with legacy systems, those simple-minded approaches may work well for consumer-based commerce but cannot hope to add value in the business place. Hence, electronic data interchange is not "dead" by any means. It will continue to be a viable and cost-effective solution for business as long as systems integration is important.

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With regard to your recent article "The Once and Future EDI": Well said.

Martin Herzfeld
pmg@dnai.com

READING BLUEPRINTS

It was with great interest that I read Barbara Reilly's column, "Blueprints for the Electronic Store" [Dec. 15, 1996/Jan. 1, 1997]. The article was right on the money regarding the need to address architecture and infrastructure.

Recently, I led efforts at BellSouth to transition its staff to object-oriented development. The transition addressed tools, training and mentoring (infrastructure), and the development and systems architecture. Changes of this magnitude require three assets that are very difficult to come by in today's IT shops: time, money and management commitment.

While it is possible to document the cost of technology migration and to attempt to quantify the benefit in a business case (thereby getting an allocation of time and money), without continuous management buy-in, efforts will quickly be stymied and will eventually fail. That is true of any technology migration, whether object orientation or electronic commerce.

I also appreciated Reilly's focus on the three styles of Internet-compatible online-transaction processing architectures and the need to evolve from the lowest to the highest over time. While she noted many products in the "distributed presentation" category, the "remote presentation" and "distributed function" areas were noticeably devoid of tools. Such is the case as technology matures.

Our company, Applied Reasoning, is preparing to release a product that fulfills the need for remote presentation. Classic Blend allows the user interface to be deployed using Java (preserving all user interface functionality), while keeping the business logic and data secure within the enterprise.

Norman Bunn
Director of Operations
Java, Smalltalk and
Internet Solutions
Applied Reasoning
Raleigh, N.C.
bunn@arscorp.com

FINGERS OUT OF HAND

Hey, those drawings on Pages 48 and 63 ["The Electric Handshake," Dec. 15, 1996/Jan. 1, 1997] showing six-fingered hands are a little scary! What's the implication there?

Ronne Rogin
Contract Specialist
U.S. Department of State
Washington
RoginR@IMMFAWPOA.us-state.gov

Our design department tells us that the extra finger was intentional. The artist's style is to draw big hands with many fingers. The original design called for seven(!) fingers, but there just wasn't enough space.

WINDOW SCREENING

While reading the Dec. 15, 1996/Jan. 1, 1997, special issue, I noticed that on the first page of each major article there is a "Reader ROI" window summarizing the content of the article. I find the window most helpful. Congratulations on an excellent idea.

Gary Moss
Director of Information Services
MBC Group
Minneapolis
wgm@winternet.com

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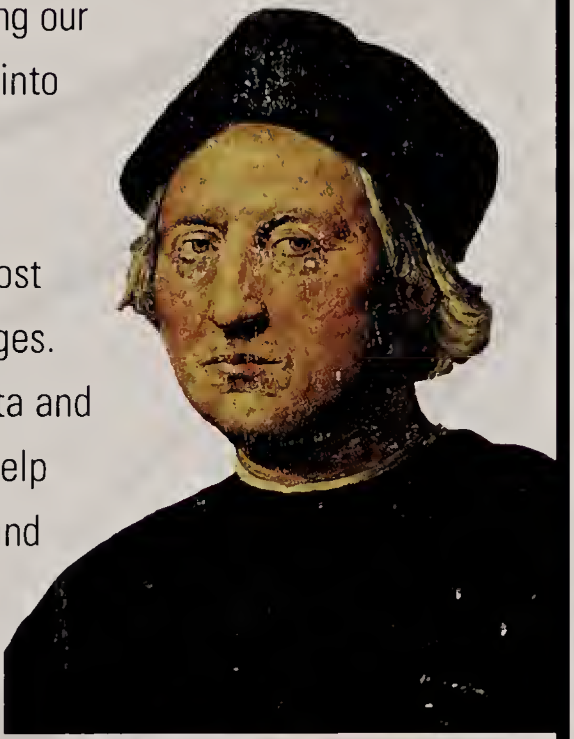

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Publisher's Note

> "The journey to component-based development is not easy, but it's one that everyone in IS is going to have to make over the next few years."
>
> *–Wayne Ratz*
> *Vice President of Application Systems*
> *General Accident Insurance*

Application software is the one of the most critical components to enterprise success. Think back about 15 years or so to when word processing and spreadsheets ruled the desktop. The biggest benefit was decreased duplication of effort. One could create templates to use over and over again, reducing the reinvent-the-wheel syndrome that was once so prevalent in the business world.

Although the concept of reuse has been around for a while, some companies are beginning to apply the idea to their underlying software code. CIOs have started asking themselves, "Why start from scratch when there's a possibility of reusing software code from other applications?" If your company already is squeezing every ounce of productivity out of its people, it makes sense to look at software-code reuse as a viable alternative to building applications from the ground up.

As you will read in our special report on software reuse, beginning on Page 34, the biggest barriers to component-based development are cultural—not technological. But changing minds and processes is what the CIO's job is all about. Working closely with vendors, outsourcing partners and software developers is the key to getting your IS department to embrace new concepts—especially those that will keep your company competitive.

P.S. Please be sure to join us May 18-21 at the next WebMaster Perspectives conference, "A Tale of Two Webs: Making Your Intranet and the Internet Pay Off," at the Doral Golf Resort & Spa in Miami. For more information, visit *www.cio.com* or call us at 800 355-0246.

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Which professional services firm is tops on Information Week's list of biggest and best technology users?

the answer is

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Trendlines

NEWS, INSIGHT, HUMOR, REVIEWS

Edited by Alice Dragoon

Changing Channels

MUST-SEE-NOW TV Sure, Must See TV is entertaining. But must-see-now TV—for example, getting the local weather forecast without having to wait till the end of the evening news—may be just around the corner. Using technology that's been available for about 20 years, cable broadcasters such as the Weather Channel, Court TV and Cable News Network Inc. (CNN) plan to transmit information from the Web to cable subscribers' existing set-top boxes. They'll do it by tapping into the vertical blanking interval (VBI), ten 9,600-bps data lines available in every U.S. broadcast or cable channel.

U.S. broadcasters have long relied on VBI for closed captioning, and European broadcasters have used it to transmit teletext (text broadcast over TV signals) for years. But recent technological developments have turned VBI into a hot commodity—and may hasten the adoption of interactive TV.

In October 1996, the Japanese network TV Tokyo began broadcasting a half-hour game show in which viewers answer teletext survey questions in real-time using their remote controls—the only input device needed. Based on a positive response, TV Tokyo, which has 14 million viewers, has expanded its interactive lineup into prime time, says Barak Kassar, senior manager of

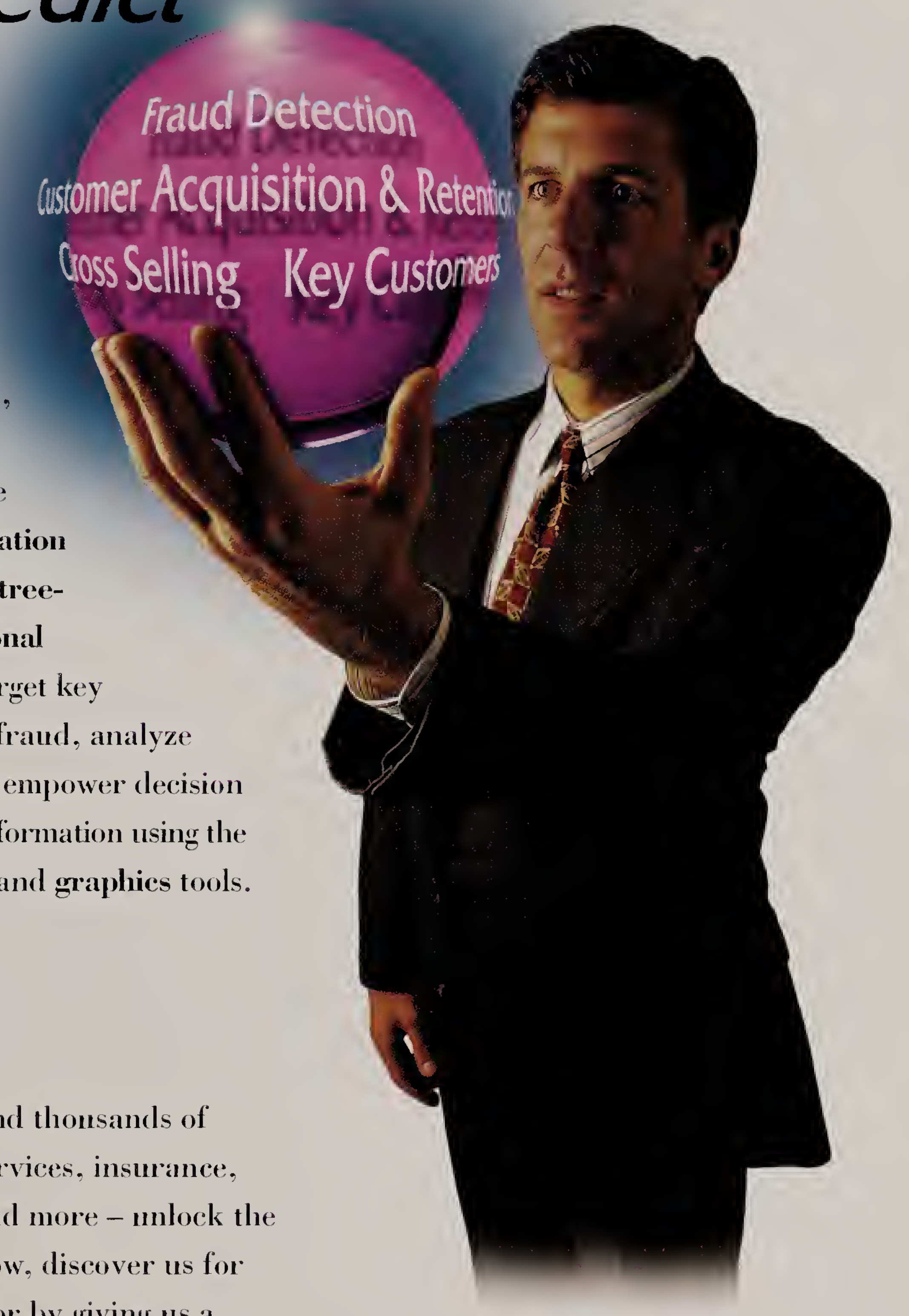
The Young and the Networked

TEEN ADMINISTRATORS Can't find qualified people to troubleshoot your network? You may want to check your local high school. Believe it or not, 100 high schools across the country have begun turning out teenage Novell NetWare administrators—certified ones at that.

Two high schools in Charlotte, N.C., are among the first to participate in the Novell Education Academic Program, a four-semester classroom and internship program that trains students in the ins and outs of NetWare. After high school, graduates of the program can enter the technical workforce directly or go on to higher certification levels such as CNE (Certified NetWare Engineer). Local businesses have donated the computers and wiring for the program, and Cedalion Education, a Charlotte-based technical training company, is providing teacher training and project management. A grant from the state of North Carolina covers teacher salaries.

The Charlotte program's sponsors—the Information Technology Council of the Charlotte Chamber of Commerce, Cedalion Education and the Charlotte-Mecklenburg School District—plan to add Microsoft to the curriculum and may eventually roll out the program to the entire school system. "One classroom in each of the 12 high schools could generate 500 students per year with a vendor certification," says James R. Bensman, CEO of Cedalion. For more information on the Charlotte program, contact Cedalion at 704 549-4765 or *www.cedalion.com*. For information on Novell Inc.'s education program, call Aaron Osmond, academic programs manager for Novell's education division, at 801 222-7890 or visit *http://education.novell.com*. ■

ILLUSTRATION BY LISA MANNING; PHOTO BY CARL VANDERSCHUIT/FPG INTERNATIONAL



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corporate communications for Wink Communications, the Alameda, Calif.-based company that invented the technology behind TV Tokyo's Intertext and similar teletext services.

Between Feb. 5 and March 5 of this year, the Weather Channel tested Wink's teletext technology on 50,000 cable subscribers in Cincinnati. During the trial, the Weather Channel continuously broadcast local weather forecasts in a Web-like hypertext format; viewers used their remote controls to navigate through information displayed on their television screens. Once the service goes live, ski reports likely will be added as well. Eventually, the Weather Channel plans to deploy Wink's technology nationally to let viewers access local content and—it hopes—view interactive advertisements. "The application allows us to [add value] for our advertisers," says Todd Walrath, director of product development for the Weather Channel. But without national reach, he says, it's hard to convince advertisers that interactive ads are worth the investment.

As one of the first interactive technologies that doesn't require additional hardware in the home, teletext capability—which can be activated by downloading Wink software to viewers' cable boxes overnight—might help broadcasters find themselves a niche between home PCs and Web television, Kassar says. "Simplicity really is the key," he says. "Sure, some people using [Wink] are Web-savvy, but others are not going to be computer-literate. The whole idea was to figure out a way to do this inexpensively so the software could just fit in the cracks of the equipment people are already buying."

With 250 million televisions in the United States, even a market share of 1 percent for a new TV-based interactive service could guarantee 250,000 viewers, which equals the Weather Channel's daily count of unique visitors to its Web site at *www.weather.com*. "We keep a special eye out for television-type technologies," says Walrath. "They could be twice as big as your Web site." *–Heath Row*

Known Quantities

VICTIM NOTIFICATION On Dec. 6, 1993, Donovan Harris shot and killed his ex-girlfriend, Mary Byron, as she left work at a shopping mall in Jefferson County, Ky. A few days earlier, Harris had been released from jail on bond after allegedly kidnapping and raping Byron at gunpoint. Byron had no idea she was at risk for a second attack, because no one had told her Harris had been freed. She died on her 21st birthday.

Although Byron's murder was a tragically common crime, in its aftermath came something new: an automated phone notification system for victims of violent crime. A year after Byron's death, her parents helped unveil the Victim Information and Notification Everyday (VINE) system. Today, the state-sponsored system operates 24 hours a day, 365 days a year, notifying victims throughout Kentucky when criminals have been released from jail or moved to alternative programs such as home incarceration. Victims anywhere in the state can register over the phone to receive automatic updates on the status, location and next court date of inmates. When a prisoner's status changes, VINE begins calling the registered victim every 30 minutes for 24 hours until he or she answers the phone and punches a four-digit confirmation number on the telephone keypad. A Dialogic Corp. voice-recognition feature and call-center operators enable people without touch-tone phones to register with VINE as well. So far, 6,885 victims have registered in Jefferson County.

"The Jefferson County VINE interfaces directly with the county jail's Hewlett-Packard mainframe system," says Yung Nguyen, co-president of Louisville-based VINE Co., a private company that developed the technology. But VINE is compatible with just about any platform, he says. The system's proprietary software, which was developed in C and runs on PCs, links directly into correctional departments' computerized criminal booking systems.

Today, some 300 counties in more than 18 states have ordered the system from the VINE Co., and other applications of the technology are in the works. For instance, VINE will allow Ohio police to access crucial information around the clock such as whether a subject of a restraining order has the right to carry a gun. And in Pennsylvania, VINE is linked to the state's court systems, making it possible for a parent who shares custody of a child to find out if the other parent has been in trouble with the law. For details, call the VINE Co. at 502 561-8463. *–Peter Fabris*

ILLUSTRATION BY DANUTA JARECKA

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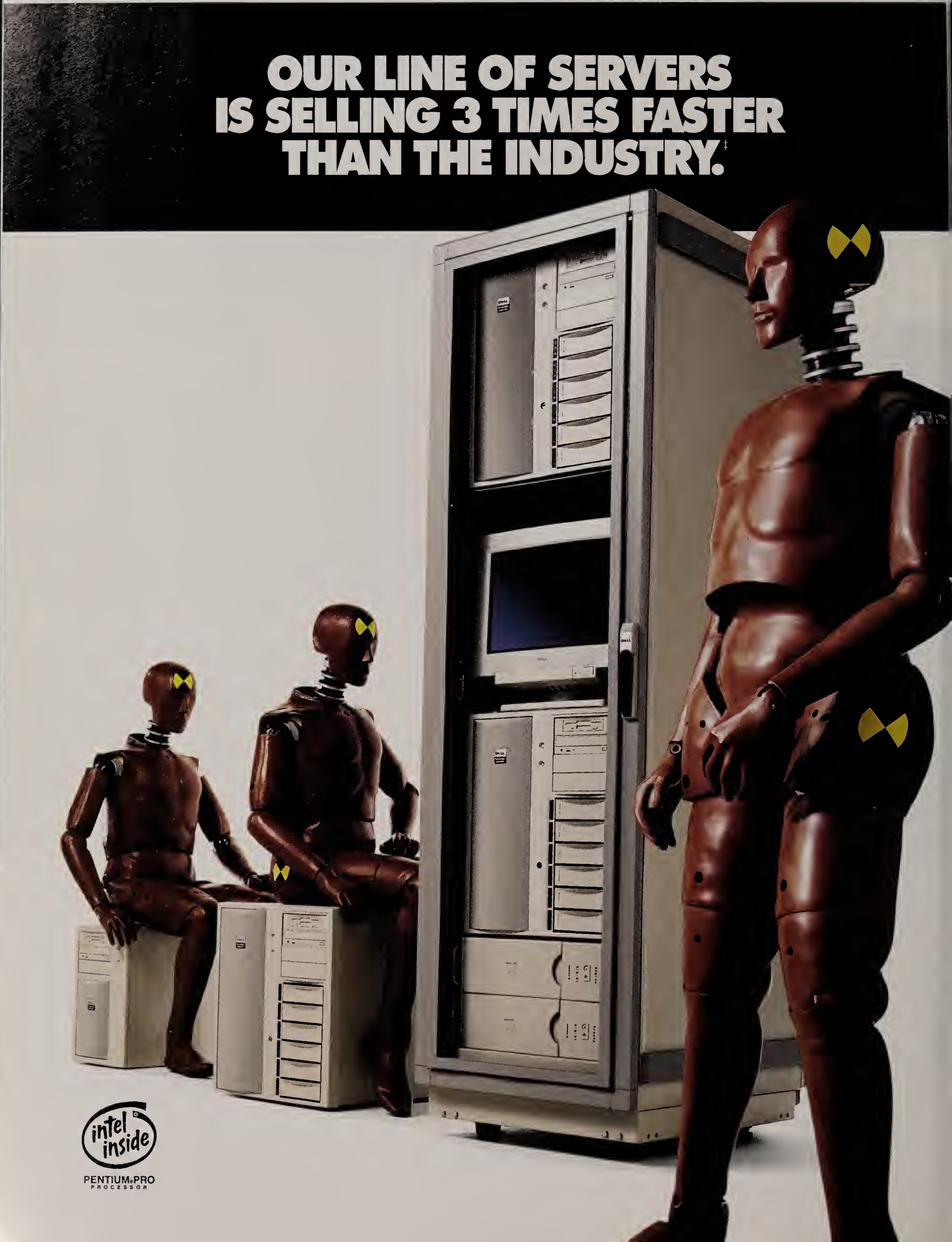
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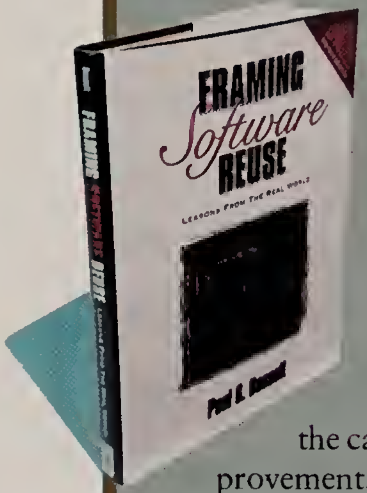
Trendlines

Off the Shelf

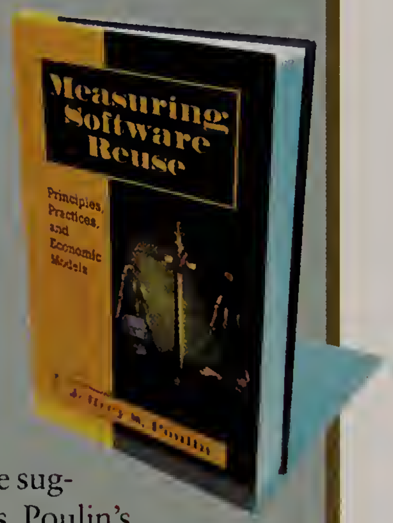
Software Reuse Reading

FOR A COMPREHENSIVE LOOK at component-based development, we recommend Paul G. Bassett's **Framing Software Reuse: Lessons From the Real World** (Prentice Hall, 1997). Bassett, a 30-year IS veteran and senior vice president of research at Netron Inc. in Toronto, speaks to executives and technical managers in a voice free of tech-speak. He also delivers on the book's subtitle by including the results of an independent audit of development productivity among nine organizations that build applications from reusable components. You'll find familiar names represented; a large telephone company, a major bank and a leading retailer were among the study participants. The audit's bottom-line finding: Average productivity on projects undertaken by the nine reuse organizations was nearly 10 times higher than that on more than 4,000 completed business systems projects developed in traditional IS shops. Bassett describes in exquisite detail the calculations that yielded that order-of-magnitude improvement, although reading the book might have been easier had the statistics come later in Bassett's exposition. He likely put the study stats first because he knows that executives want results, not vendors' promises. It's a forgivable sin.



Frame technology—Bassett's invention and the methodology the study companies used—and object orientation have subtle differences that may interest technical managers. Fortunately, the details are largely confined to one section of the book that an executive can safely skip in favor of the book's discussion of what a commitment to reuse means in managerial terms. Bassett proposes a diagnostic of organizational readiness akin to the Software Engineering Institute's Software Process Capability Maturity Model. He also discusses how CIOs should deal with their customers and provides sound advice on managing the transition to a culture of reuse. As a primer in software reuse and its benefits, pitfalls and rewards, Bassett's book is well worth a reader's attention.

Because it's hard to manage what you don't measure, Jeffrey Poulin addresses the principles and practices of reuse metrics in **Measuring Software Reuse: Principles, Practices, and Economic Models** (Addison Wesley Longman, 1997). In addition to making a strong case for reuse measurement, Poulin details what to count as reuse and how to count it. He presents several models for gathering measurements and evaluates their suitability to various situations. A chapter on how to use metrics to motivate software reuse suggests ways to evaluate results published by others. Poulin's work is a nice complement to the statistics in Bassett's book.



–Miryam Williamson

Wannabe@ smartypantsU.com

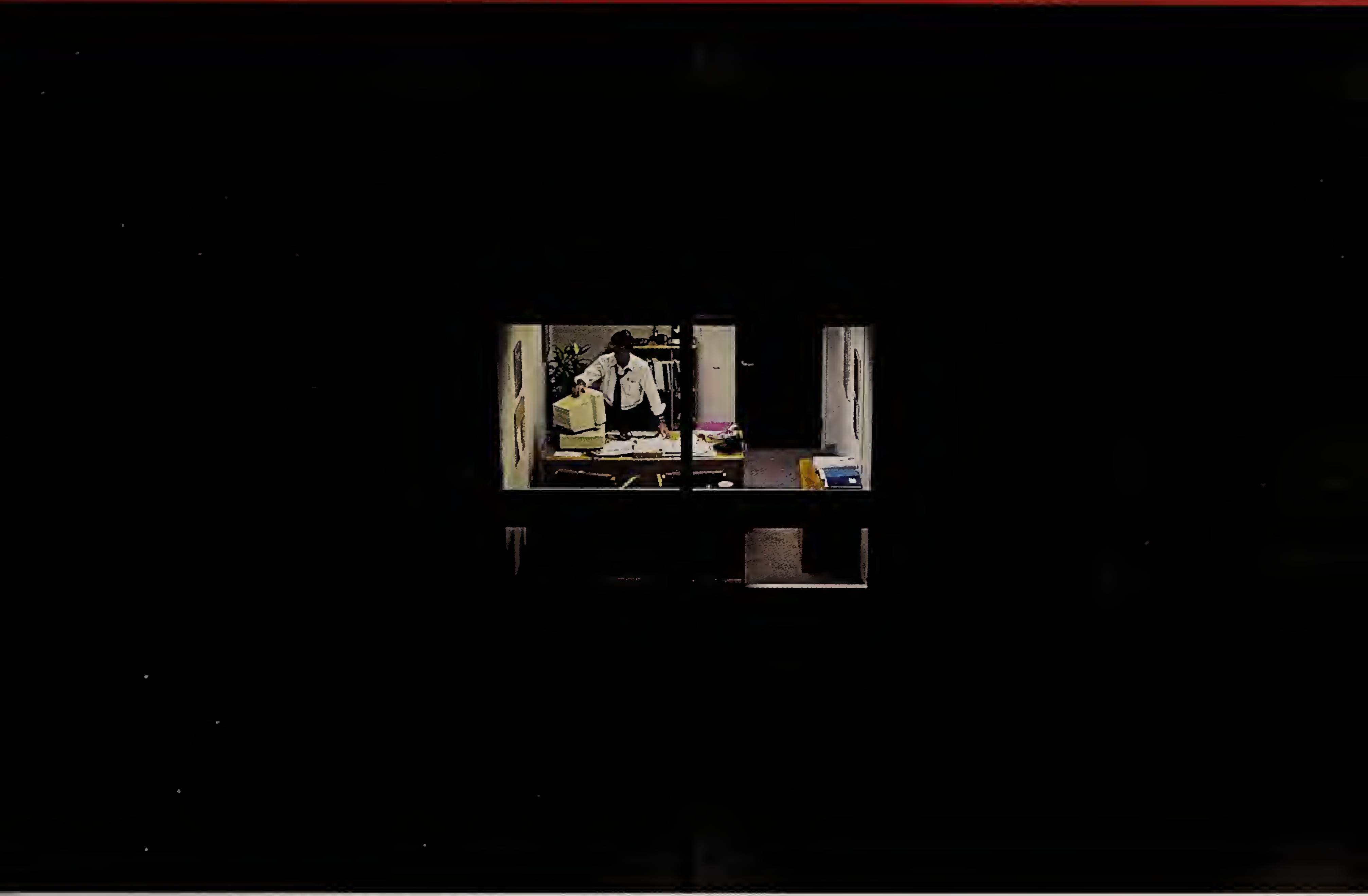
NAME DROPPING In a status-obsessed society, something as seemingly insignificant as your e-mail address may speak volumes about you. Those who feel pressed to impress might be willing to pay for one that says what they want people to hear. One company betting on that willingness is New Century Technologies Inc., which offers its customers the cachet of a prestigious school affiliation without the agony of taking the SATs or sitting through another semester of semiotics. For just $25 a year, the company rents e-mail aliases that include a top university's domain name. The so-called vanity address easily might be mistaken for the real McCoy if the recipient doesn't notice that it ends in *.com* instead of *.edu*.

Although it might be handy to have prospective customers thinking you're a Harvard man each time they contact you at *john@harvard.com*, poseurs in the wired world may face harsh censure. Officials from Georgia Tech and Florida State universities have already spoken up on the subject in the *Chronicle of Higher Education*, and both schools plan to fight any attempt to misuse their names. Allan Ryan, university attorney at Harvard College, says that his institution keeps a watchful eye on the use of its name. "If our name were being used in a way that might confuse the public mind, then we would have to take action," he says.

So before you ask for an e-mail P.O. box on Park Avenue, make sure your request won't land you on Skid Row. ■

ILLUSTRATION BY LISA MANNING; PHOTOGRAPHY BY VITO ALUIA

To improve productivity, it's not your people who have to work harder. It's your software.



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Trendlines

software reuse

Hey, Hey, We're Like Monkeys

Paul G. Bassett, senior vice president of research and one of the founders of Netron Inc. in Toronto, on the concept that small modifications in software components can account for big differences in the applications built with them: "Few people are aware that we share over 98 percent of our genes with the chimpanzee. You can have small differences accounting for huge swings in the ultimate shape and behavior of things. The same is true with software."

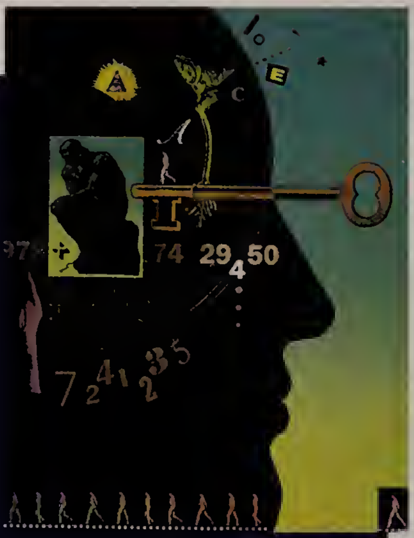
The Calm Before the Storm

"Components are going to go through an absolute tornado of activity in October and November of 1997. I can be that precise. There will be major commitments from some important players in the first half of 1997. The world's largest industrial corporation, based in Europe, will reveal that it has been building components with these vendors for some time. By fall, interest and excitement about components will have reached a critical mass, and customers will be buying components and starting component assembly projects in volume."

–Brian Morrow, director of component-based development for Texas Instruments Inc.

For a special report on software reuse,
SEE PAGE 34

Minding Your Business



USE YOUR HEAD In Topeka, Kan., it's illegal to read people's minds for money. But several companies on the East and West coasts are developing technologies that will enable people to operate computers, play video games and paint pictures using their bioelectric impulses such as brain waves and heartbeats. Many early adopters are using the technologies for entertainment and artistic applications, yet business uses are not just the stuff of science fiction. IBVA Technologies Inc., for example, is using its technology to monitor consumers' responses to product packaging, and a company called The Other 90% has developed a six-word vocabulary that users can think instead of type. (You think "inventory," and the word appears on your screen.) Here, then, are three big ideas developed by companies that are putting their money where your mind is.

The Big Idea:	**BioMuse and the hands-free controller**
Company:	BioControl Systems Inc. *Palo Alto, Calif.*
Body Parts Involved:	Wireless electrodes attach to the skin
Reading Material:	Muscle activity, eye motion, heart rate, brain waves
What It Does:	Gauges depth perception, fires guns and controls animated characters in games
Early Adopters:	Volvo Car Co., IBM Corp., Notre Dame University
Piece of Their Mind:	"We are able to use the face to control a computer mouse. If you've got a head, you can access the Net." *–Anthony Lloyd, vice president of sales for BioControl*

The Big Idea:	**Interactive Brainwave Visual Analyzer**
Company:	IBVA Technologies Inc. *New York*
Body Parts Involved:	Control pack is worn in a headband
Reading Material:	Brain waves
What It Does:	Compose music, turn on laser-disc players
Early Adopters:	Lucent Technologies Microelectronics Group, Tandem Computers Inc.
Piece of Their Mind:	"Most people take about 20 minutes to learn how to control their brain waves, but some take longer. This sort of thing come much easier to people who have been meditating for years." *–Helen Meschkow, executive vice president of technical and customer support for IBVA*

The Big Idea:	**MindDrive**
Company:	The Other 90% *San Rafael, Calif.*
Body Parts Involved:	MindDrive sleeve fits on a finger
Reading Material:	Heart rate, temperature, composite neural activity
What It Does:	Play skiing and bowling games, decide whether friends fib
Early Adopters:	Miramax Films, Easter Seals Society
Piece of Their Mind:	"The first time people do it, you watch their face and they're totally amazed. People who go to the computer store every day are more apt to accept things at face value than a head of MIS, who might want to tear it apart and figure out the technology." *–David Weiss, a technology consultant for The Other 90%*

ILLUSTRATION BY JOHN PACK/SIS, CHART COMPILED BY HEATH ROW

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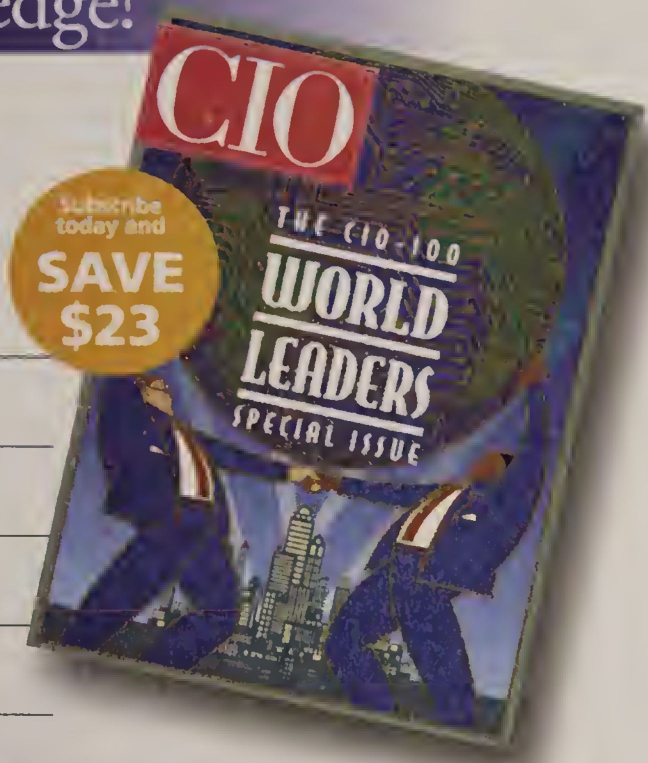

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Gartner View *Edited by Perry Glasser*

INDUSTRY ANALYSIS FROM THE RESEARCH COMMUNITY

Once Is Not Enough

Embarking on a reuse program requires more than simply announcing the program's existence

BY RICHARD HUNTER

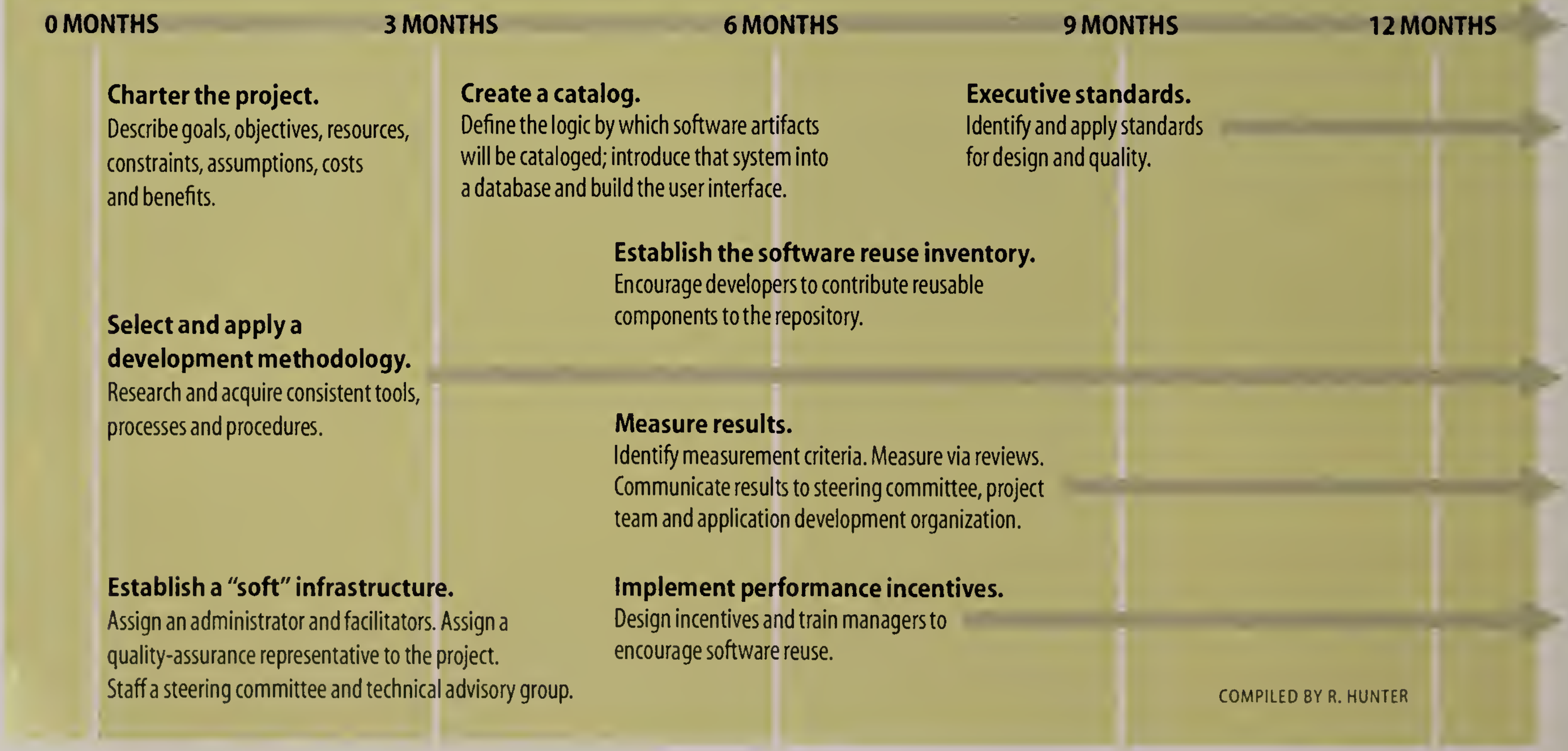
SOFTWARE REUSE is among the most discussed and least implemented of all approaches to improving the quality and productivity of an IS organization. The two concepts underlying reuse are so simple that they hardly require explanation: First, do not reinvent that which has already been invented; second, construct new systems and enhance existing systems using building blocks that already have been tested and proven.

Just as many people avoid beginning an exercise program because it requires a change in routine, systematic effort and some initial pain, so organizations avoid software reuse implementation. And just as the benefits of exercise are obvious, visible, well-documented and not very long in coming, so are the benefits of software reuse. The benefits of an exercise program are easy to measure: Just stand on a scale and you'll see them. Calculating the return on investment of software reuse, however, is a bit more tricky.

An estimated 75 percent of all application development organizations operate at level one of the Software Process Capability Maturity Model, which was created by the Software Engineering Institute of Carnegie Mellon University. At level one, an organization has no development methodology or formal procedures across projects, and budgeting is usually done on a project-by-project basis. The good news for an information executive in such an IS shop is that within the organization, he or she can promote a reusability program as a key driver to an ongoing application development process because it's tough to argue with the twin goals of improving quality and efficiency.

Synchronizing a Reuse Program

In less than two years, an organization with a consistently applied software reuse methodology can reach a "critical mass" of developers who practice reuse



Charter the project. Describe goals, objectives, resources, constraints, assumptions, costs and benefits.

Create a catalog. Define the logic by which software artifacts will be cataloged; introduce that system into a database and build the user interface.

Executive standards. Identify and apply standards for design and quality.

Establish the software reuse inventory. Encourage developers to contribute reusable components to the repository.

Select and apply a development methodology. Research and acquire consistent tools, processes and procedures.

Measure results. Identify measurement criteria. Measure via reviews. Communicate results to steering committee, project team and application development organization.

Establish a "soft" infrastructure. Assign an administrator and facilitators. Assign a quality-assurance representative to the project. Staff a steering committee and technical advisory group.

Implement performance incentives. Design incentives and train managers to encourage software reuse.

COMPILED BY R. HUNTER

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Gartner View

Promote, Don't Simply Enable

Most industry literature on reuse begins with the premise that reuse is a technical matter and is inevitable once technical issues such as platform, tool selection and integration of systems are resolved (see "Bits and Pieces," Page 56). That viewpoint is especially popular in literature on object-oriented technology and design. However, the premise is false. Enabling reuse does not ensure reuse any more than buying a rowing machine ensures the buyer will exercise regularly. Reuse will be implemented only if managers directly foster the behaviors that are essential to reuse.

Gartner Group Inc. has identified the key elements of a program designed to *enable* reuse via relevant technical support and to *promote* reuse via changes in organizational and individual behaviors. Those elements include:

- An inventory of reusable artifacts (*any* solution that can be incorporated fully or in part into an application development project—not only executable components)
- A searchable catalog of those artifacts
- Personnel who assist users and maintain and enhance the inventory and catalog
- A methodology—a structured process that specifies when and how reuse potential is acted upon during the analysis, design and construction of an application
- A measurement program that tracks reuse and adherence to the methodology
- Design standards that specify how reusable artifacts are to be constructed
- A quality-assurance program that guarantees the technical and functional quality of the catalog and reusable inventory
- Incentive systems that encourage individuals and teams to support reuse

Calculating ROI

For a midsize to large application development organization (that is, a shop with 100 to 500 developers) that already has a reuse methodology, the first-year cost of a reuse program may range from $535,000 to $1.15 million, depending on the approach to catalog implementation and incentives (see "What Does It Cost?" this page). Subsequent annual expenditures will range from $485,000 to $795,000, not including costs for analysis and identification of reuse opportunities within the development life cycle. The cost of such activities will vary with the complexity of the project. Therefore, to be even minimally profitable, a reuse program for a midsize to large organization must return well over half a million dollars per year.

What Does It Cost?

The first-year investment in a software reuse program will vary depending upon catalog implementation expenses and personnel incentives

REQUIRED ELEMENT	LOW COST [1]	HIGH COST [2]
Catalog creation Building a usable accessible inventory	**$50,000**	**$350,000**
Catalog enhancement and maintenance Usually 20 percent of acquisition cost	**10,000**	**70,000**
Personnel Initially three full-time equivalents (with benefits) [3]	**225,000**	**225,000**
Performance incentives 20 to 30 percent of base pay for contributing developers	**250,000**	**500,000**
Totals	**$535,000**	**$1,145,000**

[1] THE LOW END ASSUMES A SIMPLE IN-HOUSE CONSTRUCTION OF THE CATALOG DATABASE AND OPERATOR INTERFACE.

[2] HIGH-END COMMERCIALLY AVAILABLE CATALOG REPOSITORIES CAN COST MORE THAN $300,000 FOR PRODUCT PURCHASE ALONE.

[3] EVENTUALLY 1 TO 4 PERCENT OF PERSONNEL ARE NEEDED.

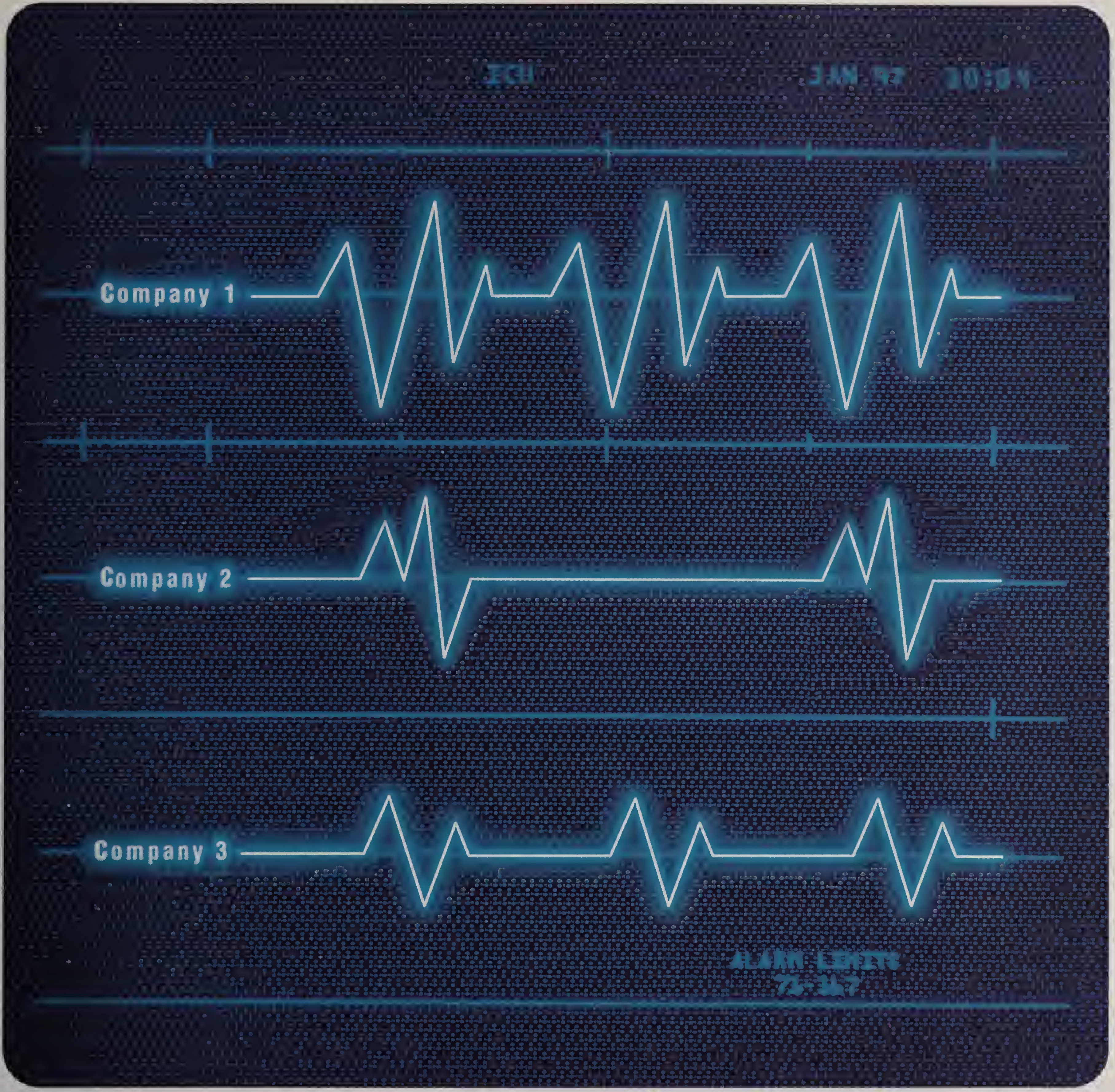
SOURCE: GARTNER GROUP INC.

Although it takes some doing, the return on investment can be calculated. Assuming a developer is paid $75,000, a company's reuse program must offset the full-time efforts of seven developers or, in a shop with 100 developers, yield a 7 percent productivity improvement to achieve the minimum required return of $500,000. Based on Gartner Group estimates that consistent use of a reuse methodology increases application development productivity by 30 percent, it is reasonable to predict that a reuse program that includes all required elements will produce an ongoing annual ROI equal to or greater than 200 percent within two years for a shop with 100 developers.

Because methodology enhances the value of architecture, its acquisition, development and implementation are essential to software reuse and to the success of the information system architecture. The application development organization that has no consistently followed methodology is well advised to obtain one even if it does not intend to focus on reuse. We estimate the cost of methodology acquisition and implementation to range from $250,000 to $800,000 over a three-year period for a midsize to large organization. Therefore, an organization undertaking a reuse program and installing a new methodology may spend well over $1.25 million within two years to establish both.

Application development organizations (especially larger ones, for which any enterprisewide initiative takes significant levels of planning, execution and follow-through) that seek improvements in delivery and quality through reuse should take notice of the important links between architecture, methodology and reuse, and act accordingly. Ensuring cooperation and coordination among the teams pursuing those initiatives maximizes overall reuse and the advantages of the architecture, with a significant combined payback.

Richard Hunter, research director of Gartner Group's Applications Development and Management Strategies service, can be reached at richard.hunter@gartner.com *or 203 316-1255.*



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SPECIAL REPORT

software reuse

INTRODUCTION

More Lives Than a Cat

IS shops that institute component-based software development reduce failure, embrace efficiency and augment the bottom line. You'd think it would be easier to persuade people to try it.

What You'll Learn

This report explores the benefits and challenges of facilitating software reuse through component-based development.

Gartner View: Once Is Not Enough 28
- The costs of implementing a software reuse program

Avoiding the Point of No Reuse 38
- How component-based development advances corporate goals
- Obstacles to CBD success and strategies to overcome them

Bits and Pieces 56
- The technology of software reuse

Component-Speak: A Glossary 58
- How to explain reuse technology to senior management

Software Reuse Resource Center
- For links to component sources, papers on the subject, and recommended books and resources, visit *www.cio.com/CIO/rc_cbd.html*

ILLUSTRATION BY GORDON STUDER

WOULD *you be the first passenger* on an airliner whose parts have just come out of the R&D shop? Or would you prefer to board knowing the aircraft was designed and constructed with parts that have successfully kept planes airborne for years? Practicing engineers, whether they specialize in civil, mechanical, electrical or aerospace engineering, select from components whose characteristics have been tested and proven for safety and efficiency. Reusability is a fundamental principle of engineering.

It's not too late to start designing software for reusability, but it's not too early, either.

By the turn of the century, observers predict, most application software will be built of reusable components. Component libraries will be considered important corporate assets. Development speed and quality will increase; time-to-market and maintenance costs will shrink dramatically. As career moves go, restructuring the IS shop for component-based development (CBD) looks like a sure winner. CBD is a technique by which applications are built from software modules designed for reuse. Modules can be subroutines, smaller applications or objects, which are packets of code that contain data and methods for manipulating that data.

It's not too late to start designing software for reusability, but it's not too early, either. The best news is this: Reusability hurdles are mainly cultural, not technological. Overcoming challenges to adoption is a matter of changing minds, not spending huge sums of money. But most software developers have yet to take advantage of reusability. In most IS organizations, every project is still considered a whole new ballgame. The software developer who searches through code libraries for macros and subroutines that might be adapted for the project at hand is rare. Although Paul G. Bassett, senior vice president of research and one of the founders of Netron Inc., a software development tool vendor in Toronto, offers an optimistic estimate of current software reuse—30 percent to 50 percent—CIOs queried for this article set that figure about 10 percentage points lower. And it's probably no coincidence that some CIOs peg the failure rate for all software projects at 60 percent; in fact, 25 percent never get delivered, says Charles B. Kreitzberg, president of Cognetics Corp., a software design and consulting firm in Princeton Junction, N.J. The rest, he says, come in late, over budget or both.

Component-based development will change that—and soon. CIOs who plan to retire or change careers within a year or two can safely ignore this advance in software creation technique, but others had better pay attention, unless they want to be blindsided by an outsourcer who offers to take over software development at a fraction of the cost, says Brian Morrow, director of CBD at Plano, Texas-based Texas Instruments Inc.

Of course, there will be initial investments in education and training (see "Once Is Not Enough," Page 28). Although components built with reuse in mind cost more at the outset, their cost drops dramatically when they are reused in subsequent projects. Some ready-made components can be purchased and reused, and more are expected. "A market is emerging in readily available functionality that is dramatically cheaper than building it yourself," Morrow says. "Today we see the off-the-shelf components selling at between one-third and one-fifth the cost of developing your own." He predicts that ready-to-use component costs will drop to one-tenth that of home-grown modules over the next three years. By 2001, there will be a $7 billion componentware market, with about $2 billion in software and the rest in services, says Mike Blechar, research director of Gartner Group Inc.'s application development service in Stamford, Conn.

Savings aside, IS executives already involved in reusability projects cite a variety of benefits. At General Accident Insurance in Philadelphia, reusable components provide a uniform way of doing business across the company's insurance lines, and maintenance costs are expected to decline. In addition, one of North America's largest grocery companies is counting on CBD to help eliminate dependence on the mainframe (see "Avoiding the Point of No Reuse," Page 38). Though the advantages are many, Netron's Bassett cautions against seeing reuse as a goal in itself. "It is merely a means to many other more important ends that have bottom-line implications—things that are really important, such as improvements in quality and flexibility, and the reduction of complexity and time-to-market," he says. "There is value both to the end user and the workings of the IS environment. Reuse is a gateway to those kinds of bottom-line issues."

Bassett suggests that CBD is appropriate only at companies in which software is seen as a strategic weapon and not just a back-office function. "The answer to the question of appropriateness [for a company] is highly correlated with how long you could stay in business if your IT function was suddenly disabled," he says. "[This question] focuses attention on the real business issues," he adds. Companies that can survive without information technology for months or years can probably ignore the CBD strategy.

The journey to component-based development is not easy, says Wayne Ratz, vice president of application systems at General Accident Insurance. "But it's one that everyone in IS is going to have to make over the next few years. It's absolutely where things are going," he says. "If you can't make the change, you aren't going to be able to support the business."

–Miryam Williamson, Contributing Editor

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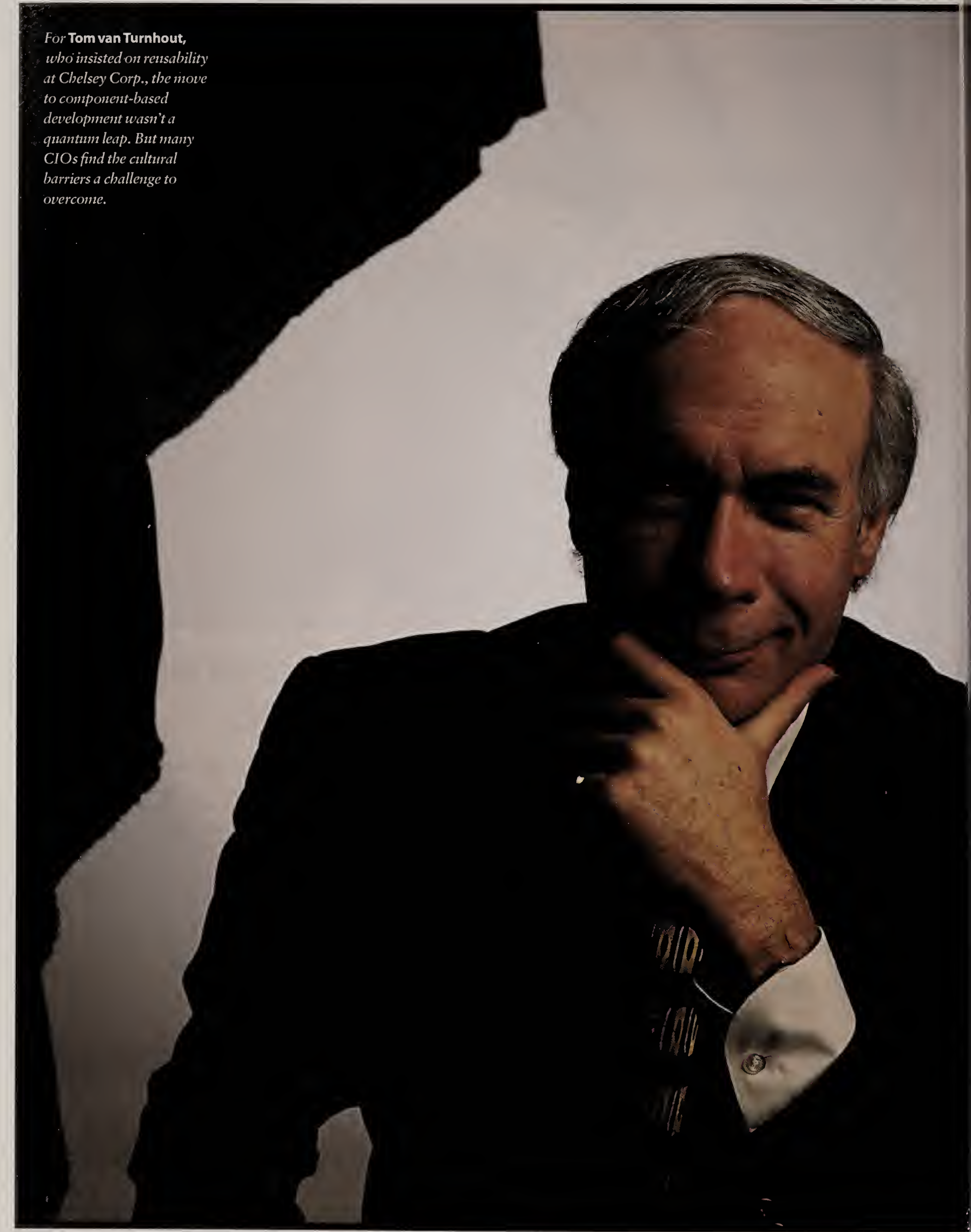
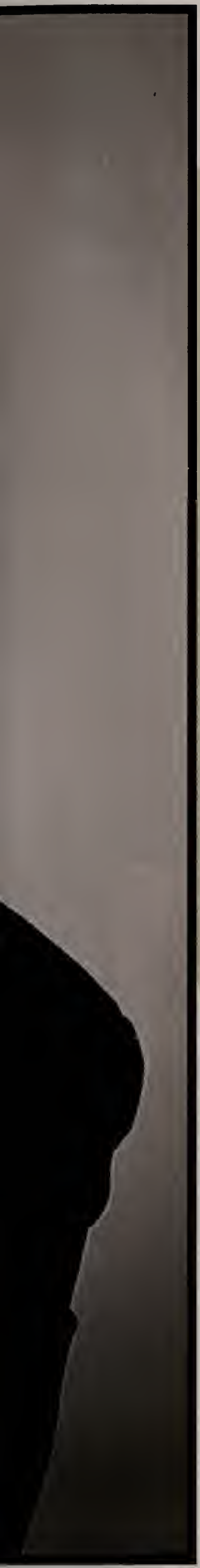


For **Tom van Turnhout,** *who insisted on reusability at Chelsey Corp., the move to component-based development wasn't a quantum leap. But many CIOs find the cultural barriers a challenge to overcome.*

PHOTO BY BABAY / FIRST LIGHT



SPECIAL REPORT

software reuse

CULTURAL ISSUES

Avoiding the Point of No *Reuse*

The advantages of component-based development seem so darn obvious, it's a wonder everyone isn't doing it. But CIOs who've been there say reaping the benefits of software reuse hinges on overcoming a bevy of cultural barriers.

BY MIRYAM WILLIAMSON

EVERY *CIO's worst nightmare* came true for an IS executive we'll call Oscar Foley in the summer of 1993 when a power plant operator's error blew out his company's mainframe. "Our computers were powered by diesel engines on flatbed trucks for eight weeks," says Foley, director of systems and technology planning at one of North America's largest grocery companies. "We were close to being down and out." At that point, he vowed "to get rid of the corporate mainframe so there [would] never again be a single point of failure."

The move to distributed computing meant a major redesign of the company's product database and core applications, an effort that took more than two years. Foley saw the massive project as an opportunity to tighten the IS organization's development standards and institute the practice of component-based development (CBD). Foley, the company's technical architect for more than 20 years, set out to reorganize his 50-member systems development team and ran into a wall of overt resistance. "There was a lot of low-level grumbling in meetings," he recalls. Although it took a while to decipher what the developers were really saying, Foley realized they resented giving up control of their projects—not to mention the steep learning curve of reuse technology. "They just didn't buy into the whole concept of reusable components," he says.

To make matters worse, executive management had brought in a consulting company to do a proof of concept—without telling Foley. By the time he figured out what the consultants were up to, they were arguing against the component-based development approach, calling it too risky. Foley reasons that the consultants saw no benefit for them in CBD, because they knew they might not be around to reap the rewards of reuse.

Even after the proof-of-concept project ended successfully in May 1996, resistance to CBD continued. In July, Foley confronted consultants and staff. "I told them we had proven that the technology worked and that if they weren't going to accept the reusable-component approach, we just wouldn't bother building the project. Instead, we'd go out and buy an application," he says. The threat of organizational embarrassment worked where consensus building had failed.

A working prototype that did everything but populate the database was in users' hands in September 1996. The system is slated to be rolled out by the end of March 1997, and two more CBD projects are underway. Foley says he expects component-based development to yield a 30 percent productivity gain and estimates that about 40 percent of the components built for the first project could be reused in the other two.

"With CBD, we are trying to raise plagiarism to a science, to make it systematic."
–Paul Bassett

The ability to reuse components is arguably the most important goal of component-based development, a software engineering technique in which modules are built in ways that permit them to be used repeatedly, often with modest refinements from one project to the next and occasionally in the same form. CBD represents a step toward maturity of the software development process, but as Foley discovered, taking that step can be difficult. Unlike many other advances in technology, the main barriers to embracing CBD are social and cultural, not technical and financial. Attitudes, not a lack of dollars, stand in the way.

SELLING CBD INTERNALLY

Though it cuts costs, improves quality and speeds the development process, CBD is a tough sell in many IS shops, subject to biases and preconceptions that CIOs must work to

Rethinking Methodology

To get the most out of reuse, CIOs must reconsider the development process

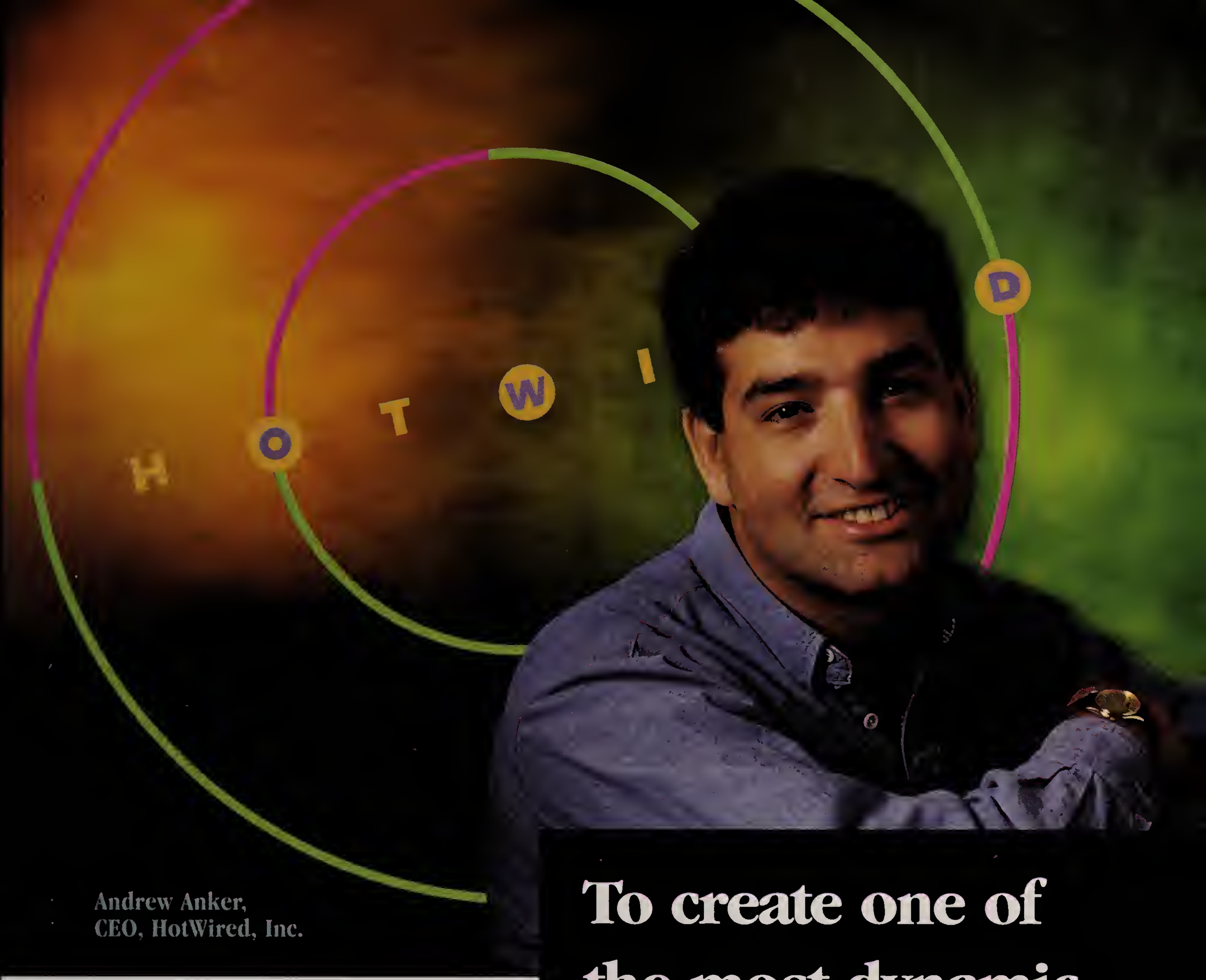
PERHAPS THE MOST difficult cultural aspect of component-based development (CBD) is that it requires organizations to adopt an entirely new development process. Most IS shops use a form of the rapid application development (RAD) technique pioneered at E.I. duPont de Nemours and Co. in the late 1980s for building small departmental systems, and the conventional waterfall methodology for enterprise systems. RAD typically involves projects of short duration—usually three months or less—with deliverables of strictly limited function at the end of each phase. The waterfall method consists of a sequence of steps, usually defined as analysis, design, coding, testing and deployment. In this method, the work in one phase stops when the next phase begins; for example, the system's design is not altered once coding starts and testing waits until coding is done. Often that sequence is violated because it actually hampers development and results in delivery of already obsolete systems. Some observers say the shop that claims to use the waterfall methodology actually has no methodology at all.

Gary Lord

The right methodology for CBD, says Gary Lord, partner responsible for the client/server solutions practice at KPMG Peat Marwick LLP in Palo Alto, Calif., is "an iterative application development methodology" in which users try out and critique portions of the application before the entire system is complete and developers make changes in an iterative fashion. A great deal more interaction between developers and users generally results. The downside is that developers may feel criticized and frustrated, a fact that management must consider and ameliorate.

–M. Williamson

PHOTO BY KENT HANSON



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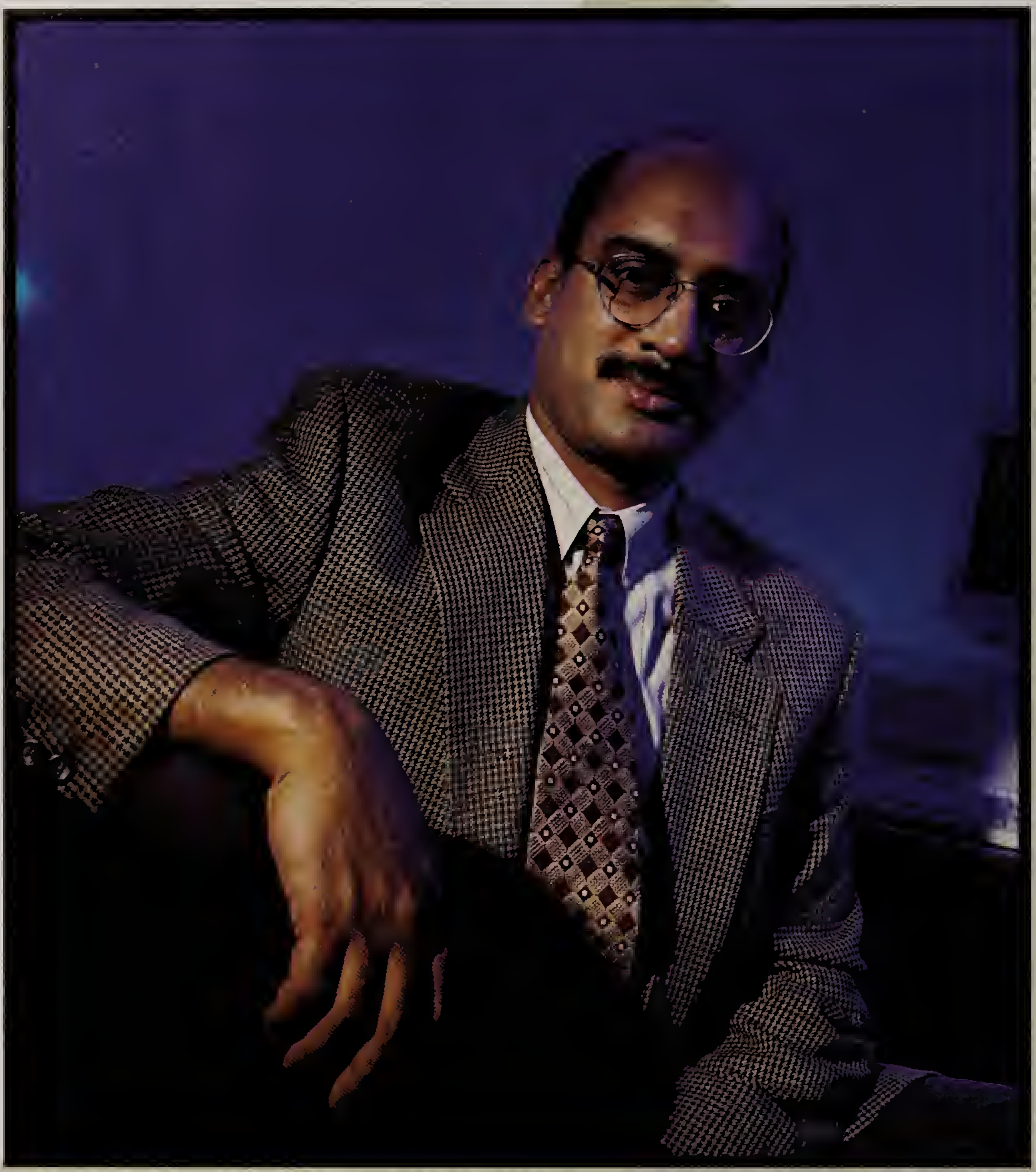

Alok Chaturvedi *advocates rewarding developers for reusing components—as well as paying royalties to components' authors.*

PHOTO BY GREG GILLIS

overcome. For one thing, using code that someone else has written seems to many a form of plagiarism. We have all been taught since kindergarten that each person must do his or her own work. "[With CBD,] we are trying to raise plagiarism to a science, to make it systematic," says Paul G. Bassett, senior vice president of research and one of the founders of Netron Inc., a Toronto-based provider of component technology. Managers must meet that objection head-on, first identifying and then negating it.

Then there's the not-invented-here syndrome. "We don't respect the way other people do things as much as we respect our own way," Bassett explains. With care and patience, CIOs can create an atmosphere in which developers learn to trust each other's programming and share what they have built. Fear of change—and more to the point, fear of failure—are common human traits. In a corporate culture in which people are punished for mistakes rather than urged to learn from them, aversion to risk results. It takes a brave manager to diagnose that problem, and even where risk taking is encouraged, as it is at Foley's company, problems can arise. "About a third of the way down our list of operating principles is the statement that we must take risks to succeed," says Foley. Still, he had to threaten to acquire the application from an outside source before his people were willing to risk doing things another way.

In addition to dealing with developers' attitudes, CIOs must concern themselves with the perceptions and intentions of their middle managers. "Like it or not," Bassett says, "managers represent the status quo. If you're trying to introduce a new way of doing things, which reuse normally is, then management becomes one of the problems." It's simply human nature to manage for one's own comfort. "Project managers in particular are apt to veto anything that is not on their perceived critical path," Bassett adds. "If they are not familiar with the concepts and advantages of reuse, it will be perceived as a distraction from getting the work done."

FINDING COMMON GROUND

Beyond paving the way for CBD acceptance within IS, CIOs must also watch out for evidence of interdepartmental friction. It isn't unusual for distinct departments and business units to have their own vocabularies, values and ways of doing things. Many companies allow and even encourage different parts of the enterprise to work as individual units—even to the point of competition. "They don't talk to each other, don't trust each other, don't share standards and don't cooperate," says Bassett. "This adds to inefficiency in the business and lack of agility in the marketplace."

In a mature CBD environment, only about 5 percent of a business unit's applications—the portion that applies business rules—is likely to be unique.

Senior management's challenge is to find a bal-

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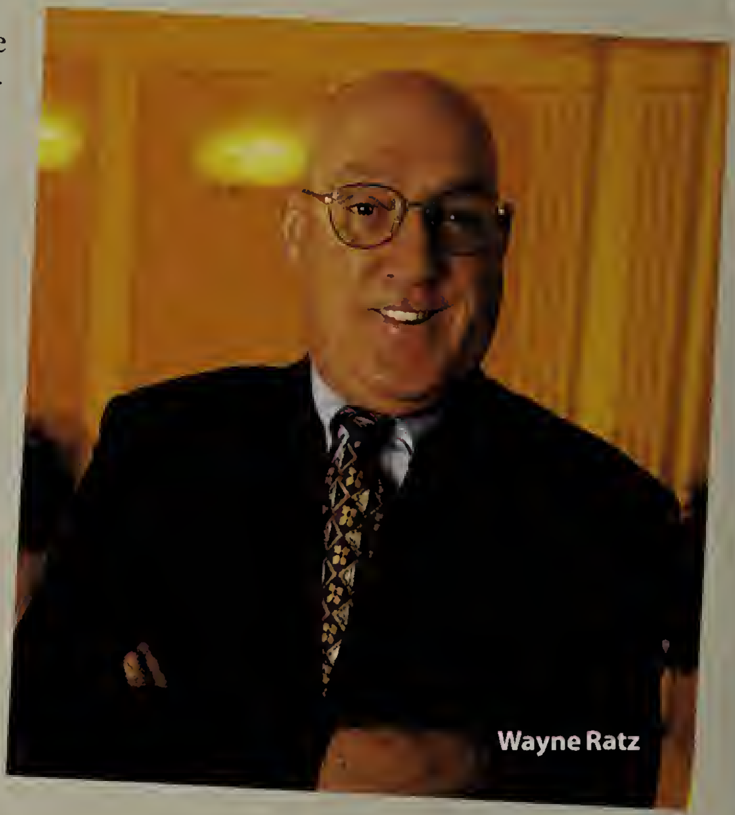
PROFILE: General Accident Insurance

It's No Accident

Thanks to component-based development, General Accident Insurance developers can be counted on to deliver new systems in a fraction of the time it once took

At General Accident Insurance in Philadelphia, plans are underway to bring distributed data and application logic back to a central host. The goal is to have the same data available to all 28 branch offices and approximately 4,000 independent agents in the United States, says Wayne Ratz, vice president of application systems. As product offerings change and new products are introduced, everyone who represents the company to its customers will have the information at the same time.

It took four tries to build a reusable rating engine that can accept different algorithms for different policies, but the entire effort took less than a year.



Wayne Ratz

A 55-member staff is replacing the company's legacy systems with client/server applications, one line of business at a time. The user interface and some processing capability will remain on client machines while a central server holds the rules for processing each insurance policy. A small-business policy application called BusinessElite was completed in 1995, a year into the process of rewriting and recentralizing the systems. A commercial auto system is slated for installation in early 1997.

Reusability and component-based technology are key to the effort. Ratz estimates that CBD enables his organization to deliver systems three to four times faster than was possible with applications written in Cobol. The project's keystone is a reusable rating engine, says Kay Bussewitz, assistant vice president of system development. But reusability was not a primary objective at first. Traditionally, Ratz explains, every time the company introduced a new product, developers would build a new rating module. "We never reused anything from before," he says. "We might reuse the theory and concepts but never the code."

Kay Bussewitz

It took four tries to build a reusable rating engine that can accept different algorithms for different policies, but Ratz has no regrets. The entire effort took less than a year.

Bussewitz had no problem getting volunteers for the initial CBD project, but even so, the learning process was not painless. "They were used to being senior programmers and knowing everything," she says. "The need to learn new tools and methods made them feel junior again. We just kept letting them know it was OK to make mistakes, that that's the way to learn." What's more, because developers take their work very seriously, the project team had difficulty coming to terms with the necessity of rework, Bussewitz recalls. During the trying times, her main concern was keeping people focused on the goal, their minds open to critiques from the agents who were the ultimate users. "It was hard for the developers to go through that, but what we have now makes it worthwhile," she says. "Everyone is really proud of it."

–*M. Williamson*

PHOTOS BY STEVE WEINREBE

ance between diversity and similarity, a key issue in component-based development. Bassett believes that balance can favor what business units have in common. "Rather than having to manage by consensus and give up economies of scale, one can recapture the coherence and control that comes with commonality," he says. Where segments of the enterprise see themselves as unique, they are likely to object to applications that incorporate components built for other units. For example, Bassett says, people in manufacturing differentiate among sales orders, purchase orders and work orders. They expect different systems to handle those different parts of the business. "But under the surface, orders are orders," he says. With CBD, it is possible to create a common structure that fulfills at least 80 percent of functionality for those three types of order systems; their diversity can be supported by the other 20 percent. Not only does that greatly decrease construction time, it minimizes coding errors and maintenance costs as well because developers are building on components that already have been tested. In fact, Bassett says, in a mature CBD environment, only about 5 percent of a business unit's applications—the portion that applies business rules—is likely to be unique.

MEASUREMENTS AND REWARDS

Without a system of measurements, however, such improvements may go unnoticed—and unrewarded. Because professionals don't like to be measured, surprisingly few IS organizations have accurately assessed their current performance. "When you keep score, most people think of a zero-sum game, as in sports, where there's always a winner and a loser," says Bassett. Senior management must address that attitude directly by instituting a system that measures the process and teams, not individual developers.

One metric Bassett recommends involves counting the number of times a component is reused. But he's quick to point out that a component doesn't have to be reused without modification to be counted. He maintains that components should be built with reusability in mind. The confusion between using a component repeatedly without change—graphical user interface components are a good example—and designing components that can be modified slightly from one application to another is "the primary conceptual problem of CBD," says Bassett. To encourage component reuse as well as designing for reusability, Bassett recommends a system of monetary rewards based on the number of modules a team reuses rather than rewarding developers for writing new code.

A variation on that theme, proposed by Alok R. Chaturvedi, associate professor of IS at Purdue University in West Lafayette, Ind., is to encourage developers to build and publicize reusable components, creating an internal market for them by establishing a system of royalty payments to the individual, team or department who authors the components—as well as rewarding those who reuse the components. In contrast with Bassett's rewards for reuse, Chaturvedi's notion also rewards designing for reusability. But the two reward systems are not mutually exclusive. Chaturvedi points out that his royalty proposal "creates a powerful incentive to build reusable components," citing his own research that shows that "even a simple royalty scheme can alter behavior dramatically and create competition for reusability within the organization."

> **"Encouraging reuse requires lots of carrots and sticks in organizations where reuse is a relatively new practice. But once it becomes systematic, incentives become unnecessary—it's just the way things are done."**
>
> *–Paul Bassett*

Chaturvedi's study found that a company offering a 5 percent royalty to the component's author can expect the library of reusable components to grow 30 percent faster than it would with a simple reward system. When a 15 percent royalty is offered, the library expands about 50 percent faster, he reports. Because authors are rewarded only when their components are actually used, the incentive to create really useful components is strong. Bassett notes that "encouraging reuse requires lots of carrots and sticks in organizations where reuse is a relatively new practice. But once it becomes systematic, incentives become unnecessary—it's just the way things are done."

Making CBD work may also require adjusting managers' incentives. In many organizations, a project manager's status and compensation are determined by the size of the staff he or she oversees. Large project teams, in which synchronization and communication are inevitably the dominant issues, are a barrier to component-based development. "If you can somehow shrink the size of the project team, then that barrier goes away. With reuse, you have the opportunity to dramatically reduce the team size," says Bassett. "But if the project manager's bonus is based on a percentage of salaries paid to the team, where is the incentive for the manager to facilitate reuse?"

PROFILE: Oracle Service Network

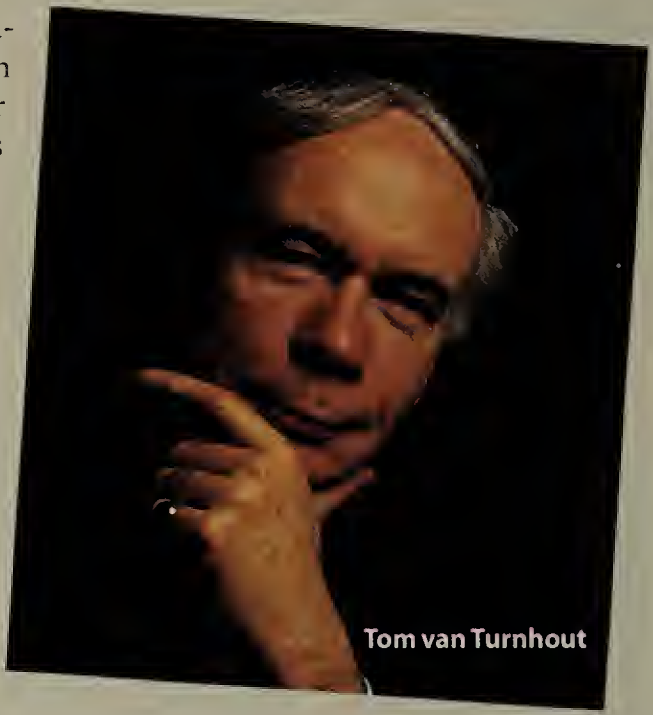
A Custom *Fit*

Applying CBD to serve a wide range of clients means designing flexible modules that can be easily customized

IN HIS 25 YEARS of service at the Chelsey Corp., a privately owned Canadian holding company in London, Ontario, Tom van Turnhout saw plenty of change, including the advent of computers. "I started when it was a manually run company," says Chelsey's former vice president of information technology, who recently joined Toronto-based St. Clair Interactive Communications Inc. as a consultant. He presided over the entire IS function, including the Oracle Service Network, a state-of-the-art call center that provides assistance around the clock to customers of companies such as automakers, insurance firms and financial institutions. Calls to the Oracle service center may come from people anywhere in the United States or Canada needing roadside, home, medical or legal assistance.

> **"The payoff of CBD must be there in the long run. Once you start reusing the initial pieces, there's got to be this humongous drop in the cost curve."**
> *–Tom van Turnhout*

People who call Oracle are in some kind of trouble and thus not apt to be particularly patient with a voice on the phone that can't solve their problem in a hurry. A customer liaison pairs the caller with a local service provider, using a GIS-based system called the Provider Locator System, which taps into customer and provider profiles to find a suitable match. "The quality of the systems affects the delivery of the service, as in every other organization," van Turnhout says. "The difference is that people call because they have a problem, and their anxiety level is probably already 110 on a 100-point scale."


Tom van Turnhout

The Oracle development team, which includes five former Cobol programmers who have also mastered 4GLs and object orientation, has three kinds of customers: call center operators, people who call those operators and the companies that contract with the call center. "My approach was always to design software within the organization as though we were selling the software to an external customer," van Turnhout says. Because he always insisted on reusability, even of ancient Report Program Generator (RPG) or Cobol modules, the move into component-based development was "not really a quantum leap."

Oracle's strategic vision calls for constantly expanding service offerings, always custom-fitted to a specific client corporation. The real challenge, van Turnhout says, was to create and test components made of business objects flexible enough to need little modification from one system to another. He says the difference in cost between component-based development and conventional development won't be known for a few more months but adds, "the payoff must be there in the long run. It's not in the initial pieces, which are more expensive. But once you start reusing them, there's got to be this humongous drop in the cost curve."

–M. Williamson

JOB SECURITY CONCERNS

The CIO who suspects that fear of layoffs may underlie resistance to CBD should make it clear to all concerned that smaller teams do not necessarily mean a smaller IS shop. Where fewer people are needed to complete a project, more projects can be undertaken at the same time. Currently, the head count of in-house IS shops "is being somewhat reduced as corporations turn to outsourcing. But this is not so much a result of component use as it is a shift in the development model," says Charles B. Kreitzberg, president of Cognetics Corp., a software design and consulting company in Princeton Junction, N.J.

Although it's wise to consider it a possible hurdle to acceptance of CBD, job security might never concern developers. Tom van Turnhout, former vice president of IT for Chelsey Corp. in London, Ontario, says fear of job loss was widespread when his company was implementing a client/server infrastructure. Employees were worried about their job

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security because of all the learning that was required. Where CBD is concerned, "I haven't found it to be an issue," he says. "The issue now is [meeting] business needs and how well the business is doing. If we keep growing because of increased productivity, the jobs will be here."

Gary Lord: *Although CBD does involve a certain amount of standardization and centralized control, a return to a completely centralized IS function is unlikely.*

WHO PAYS?

Typically, the first component-based project costs more than it would if reusability were not a design factor. Aggregating estimates from several consultants and practitioners, it seems reasonable to add at least 25 percent to the budget for the first project to cover the expense of building reusable components. If the project is charged back to one business unit, it's also reasonable to expect that the unit manager with budget responsibility will think it unfair to have to pay a premium for components that will benefit other departments.

Foley estimates that building in reusability added 9 percent to the cost of the first CBD project at his company. He considers components part of the IS infrastructure, along with the LANs, WANs and other facilities shared companywide. He avoided recrimination from the business unit by allocating some of the cost to the IS infrastructure fund. The rest was paid out of the business unit's development budget. "We have a fairly mature outlook on what we call infrastructure, and we budget for it separately," he says.

Van Turnhout brought together representatives of the groups that will benefit from the reusability of a new component and got them to agree to share the cost. "The enemy is not the department down the hall; it's the competition. And we have to focus on that," he says. "I would much rather that we all share the cost."

QUESTIONS OF RECENTRALIZATION

Some observers say the CIO who introduces component-based technology risks the enmity of the entire user community, who may see it as a ploy to return to a centralized IS function. In fact, CBD does involve a certain amount of standardization. Component interfaces must be defined and adherence enforced. To promote reusability, components should be stored in a central library or repository. Component-based applications are typically sited on a server that provides most of the processing power. Diskless computers, which some see as one step up from dumb terminals, may be the chosen desktop technology. To some, it all begins to sound like a return to the days of the mainframe in the glass house, with the IS department in control once again.

It seems reasonable to add at least 25 percent to the budget for the first project to cover the expense of building reusable components.

PHOTO BY KENT HANSON

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Appointments
MONDAY
TUESDAY
WEDNESDAY
9:30 - Meeting with Mark, Adrian and Christine
~~10:30 - Conference Call with Client~~ moved to Thursday
12:00 - Lunch with Beth
~~2:00~~ - Staff Meeting ~~4:00~~ rescheduled for Friday - call Susan to confirm
~~5:00 - Meeting with Carol to go over new projects~~ cancelled!
Bill can't make it
9:00 - Team Meeting for Budget Approval
10:30 - Conference Call with Client
~~11:00~~ - Creative Dept. Meeting on 5th Floor ~~12:00~~ ~~1:00~~ cancelled! Call Kevin to reschedule
2:00 - Meeting with Michael and Kerry - plans for seminar
4:30 - Meet with John to discuss scheduling options!!
THURSDAY
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The minute a CIO tells business users about component-based technology and how components will be stored on servers and delivered on an as-needed basis, "what you've done is reposition IS as being central to the process, and that is something that makes users very uncomfortable," says Kreitzberg. "I've been in meetings where the IS people have started explaining [component-based technology] and the users have gotten very hot under the collar. They've said, "I see. In other words, you're putting yourself back in the center and making yourself the boss again.'" That is an issue CIOs must address, Kreitzberg warns.

> **"The enemy is not the department down the hall; it's the competition. And we have to focus on that. I would much rather that we all share the cost."**
>
> *–Tom van Turnhout*

IS can counter those objections by "reinventing itself as a customer-centered service organization," Kreitzberg says. IS staff "must acquire the skills to understand users' needs and support them in their business activities rather than impose technical solutions on them. CIOs should also make certain that the choices presented to the user are couched in business, not technical, terms."

Bassett notes that although component management may be under central control, "component development should always occur in the trenches." He envisions component developers sitting next to business users for whom they are building components. "By decentralizing them, you're getting that interaction between developers and users that fosters relationships of trust. You are getting the feedback you need to refine your systems as the business keeps changing," he adds. Developers gain valuable knowledge of the business—and the work lives of those who use the systems they develop—by working in the functional areas rather than associating mainly with other developers.

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Brian Morrow, director of CBD at Texas Instruments Inc. in Plano, Texas, sees many companies in which components are being deployed on back-end servers and made available to decentralized client processors. Even when it makes sense to centralize components that support the core activities of the business (such as human resources, payroll and financial applications), components of greatest interest to the user community (such as input screens and reporting facilities) can remain decentralized, he says.

In other words, while organizations may be shifting back from total decentralization, a return to a completely centralized IS function isn't likely, according to Gary Lord, partner responsible for the client/server solutions practice at KPMG Peat Marwick LLP in Palo Alto, Calif. "The reality is that IS organizations are dispersed today, and they're never going back to the ivory towers they once were," he says. Many companies are moving toward a more balanced model, where the IS organization establishes liaisons to provide guidance to business-unit developers on the front lines. For a company using CBD, such guidance would likely include informing business-unit developers of what is available in the reusable-component library. Citing a Gartner Group Inc. model, Lord says, "IS organizations are adopting more of a hub-and-spoke or spiral organizational structure." (For more on Gartner Group's view of component-based development, please see "Once is Not Enough," beginning on Page 28).

> **To some users, component-based development sounds like a return to the days of the mainframe in the glass house, with the IS department in control once more.**

Kreitzberg cautions that both IS and business executives must adapt if organizations wish to reap the benefits of reusability. To take advantage of CBD, users will have to become more skilled in articulating their needs and understanding what is possible and available in the component library. "Users are going to have to accept responsibility for a certain level of technical expertise," he says. On the IS side, he adds, "there has to be an embrace of the user-centered design model. That means rethinking the role of IS so that [the IS staff] is sensitive to supporting its customers and believes that the success of IS depends on the customer getting what the customer wants." CIO

Contributing Editor Miryam Williamson can be reached at mwilliamson@reporters.net.

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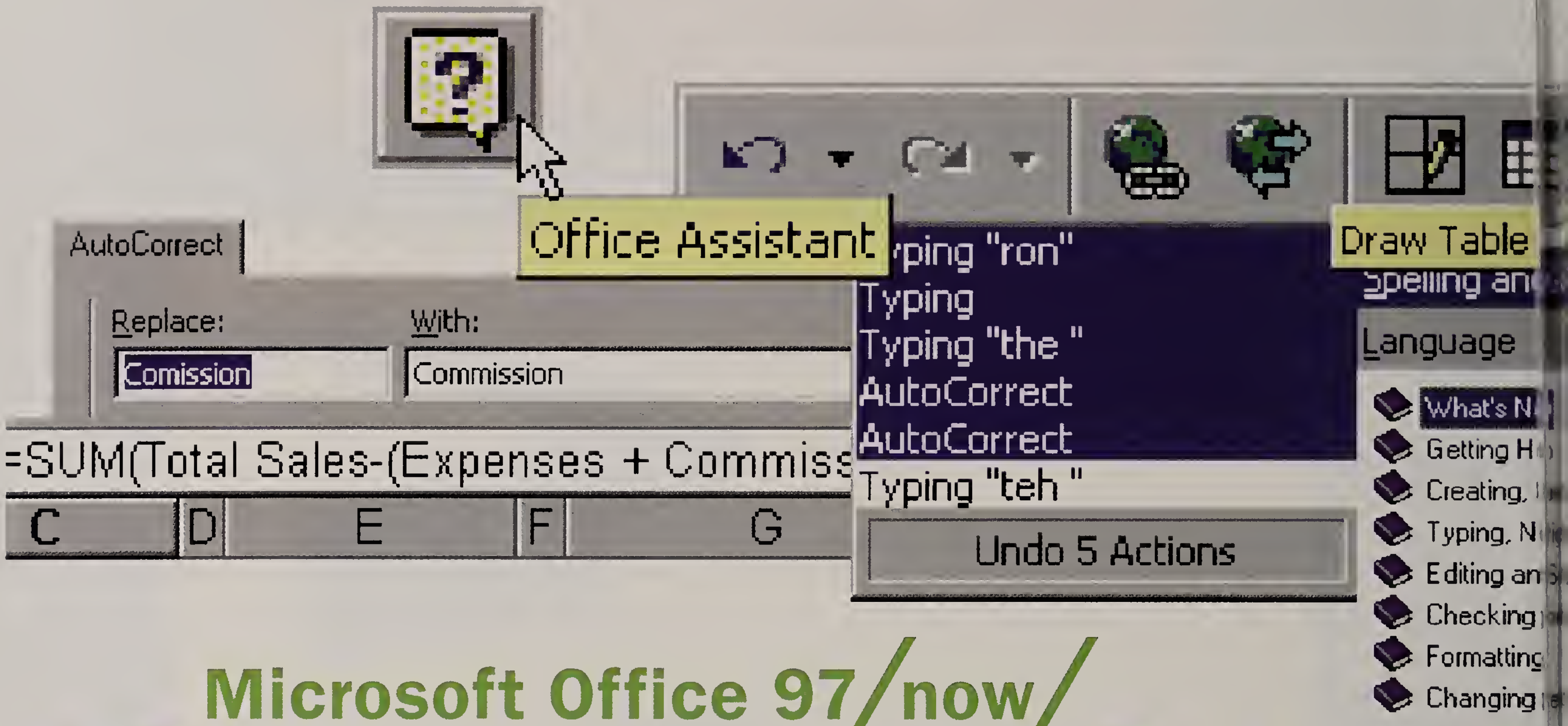

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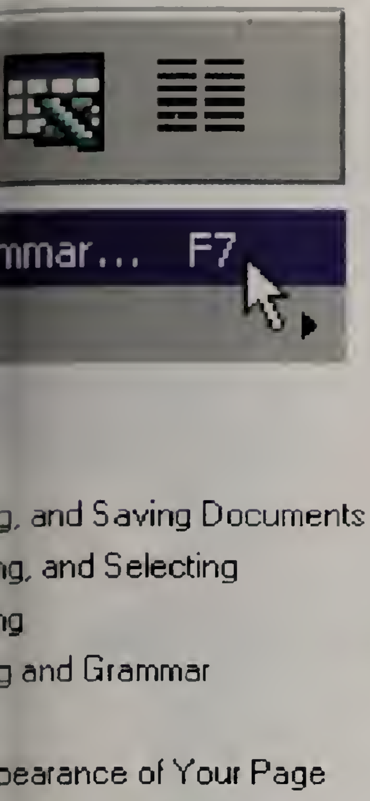

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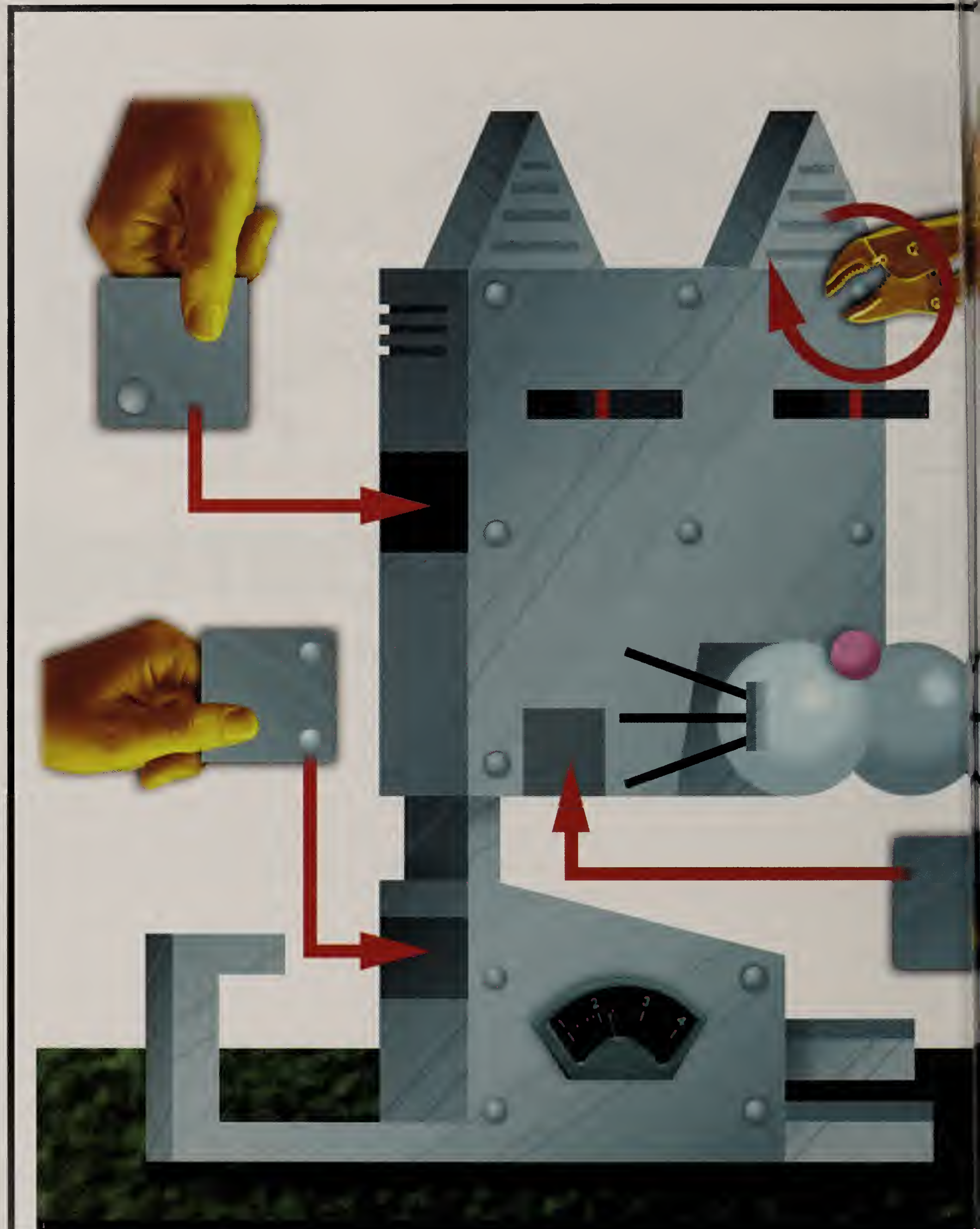
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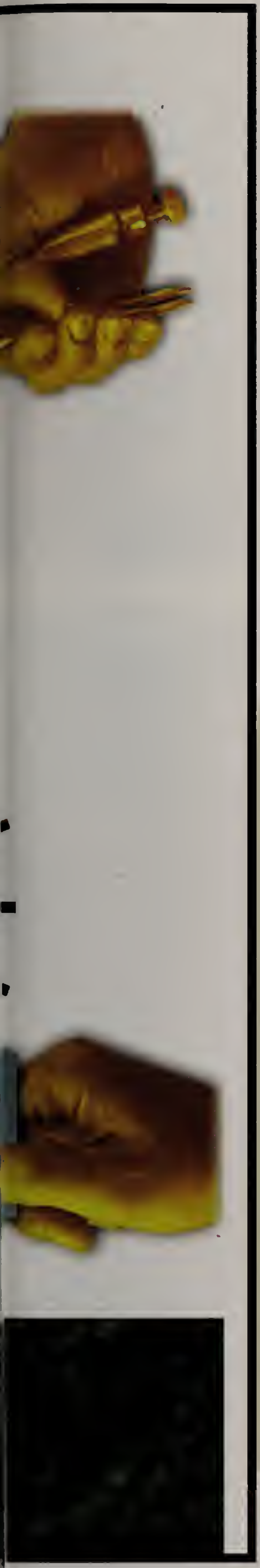


SPECIAL REPORT

software reuse

TECHNOLOGY

Bits and *Pieces*

Different kinds of component-based development still require the same technology

BY MIRYAM WILLIAMSON

TO *help a CIO make a case* for component-based development (CBD) to an audience devoid of glassy stares, some sorting of technical terms is in order. Think of components as bits of software that can be replicated and, often with minor modifications, assembled repeatedly to form any number of applications. The ease with which that can be accomplished depends on how much change is required from one application to another.

GLOSSARY

Component-Speak

The CIO who understands the lingo will easily persuade other executives of software reuse benefits

By Miryam Williamson

API
Application programming interface. A specification within a program or component that allows other programs or components to activate its functions.

Applet
A small application; a module. An applet can be a component by itself or can be combined with other applets to form a component.

Application
A component or collection of components that performs some useful task.

Application architecture
The structure of components in a system. An application's architecture is made up of its components and their relationships. (Not to be confused with an enterprise's architecture, which consists of its hardware and software components.)

Business object
An item of interest to a company; for example, a letter, a customer or an order. (*See* object.)

CBD
Component-based development.

Certification
A process by which a software component is tested to ensure it can be trusted; a precondition for inclusion in a component repository.

Client
A component or application that issues a request for service. The component or application that responds to the request is called a server. (Both terms are also used in relation to hardware.)

Component
A software module designed to be used repeatedly in developing applications, either with or without modification. (*See* module.)

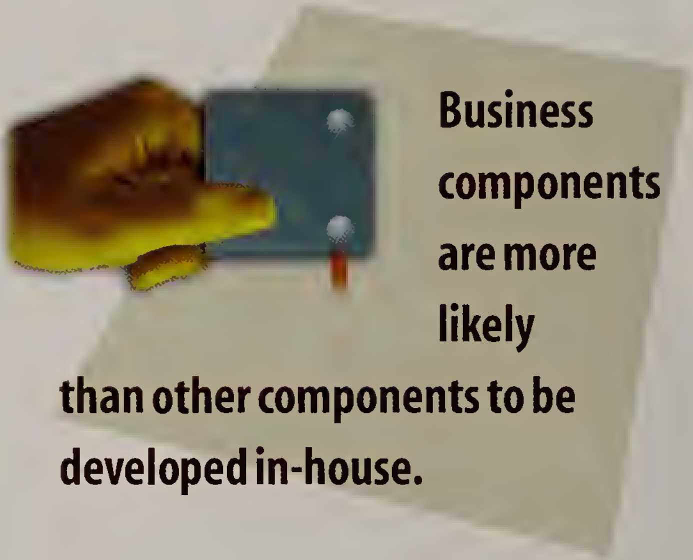
Constraint
A condition or statement that must be maintained as true; a requirement.

(Continued)

Well-designed components take the likelihood of such necessary revision into account.

User-interface components as often as not can be used without change from one application to another. A simple example of that kind of component is the Yes/No/Cancel dialog box ubiquitous to graphical user interface applications, whether of the Windows, Macintosh or X Windows persuasion. Such components are readily available in a variety of toolkits and code libraries. The supervisor who allows a programmer to waste the time required to create a new one commits an act bordering on managerial malfeasance.

Other components, again most often found in the user interface layer of an application, require minor modification from one application to the next. One such component, the drop-down list, does not vary in its basic appearance and underlying mechanism between applications but typically requires the programmer to key in the new list of available menu choices each time it is reused. Since those easily modified components are widely available and have proven functionality, it's difficult to think of reasons to create new ones.



Business components are more likely than other components to be developed in-house.

Application components, such as the programs that go into an office application suite, also can be thought of as parts to be assembled. For instance, a word-processor, a spreadsheet and an e-mail program can be embedded in a larger business application. Consider, for example, an insurance company's claims-processing system. It might bring together an imaging application that displays a handwritten diagram of an automobile accident, a forms-based application that contains the original claim data, a word-processing application on which the claims clerk drafts a letter to the customer asking for additional information and an e-mail application with which the clerk forwards the claim file to a supervisor for action. Some of those components may have been purchased while others may have been developed in-house, but if they are part of a suite, they are linked in look and feel to a menu by a uniform user interface (which is al-

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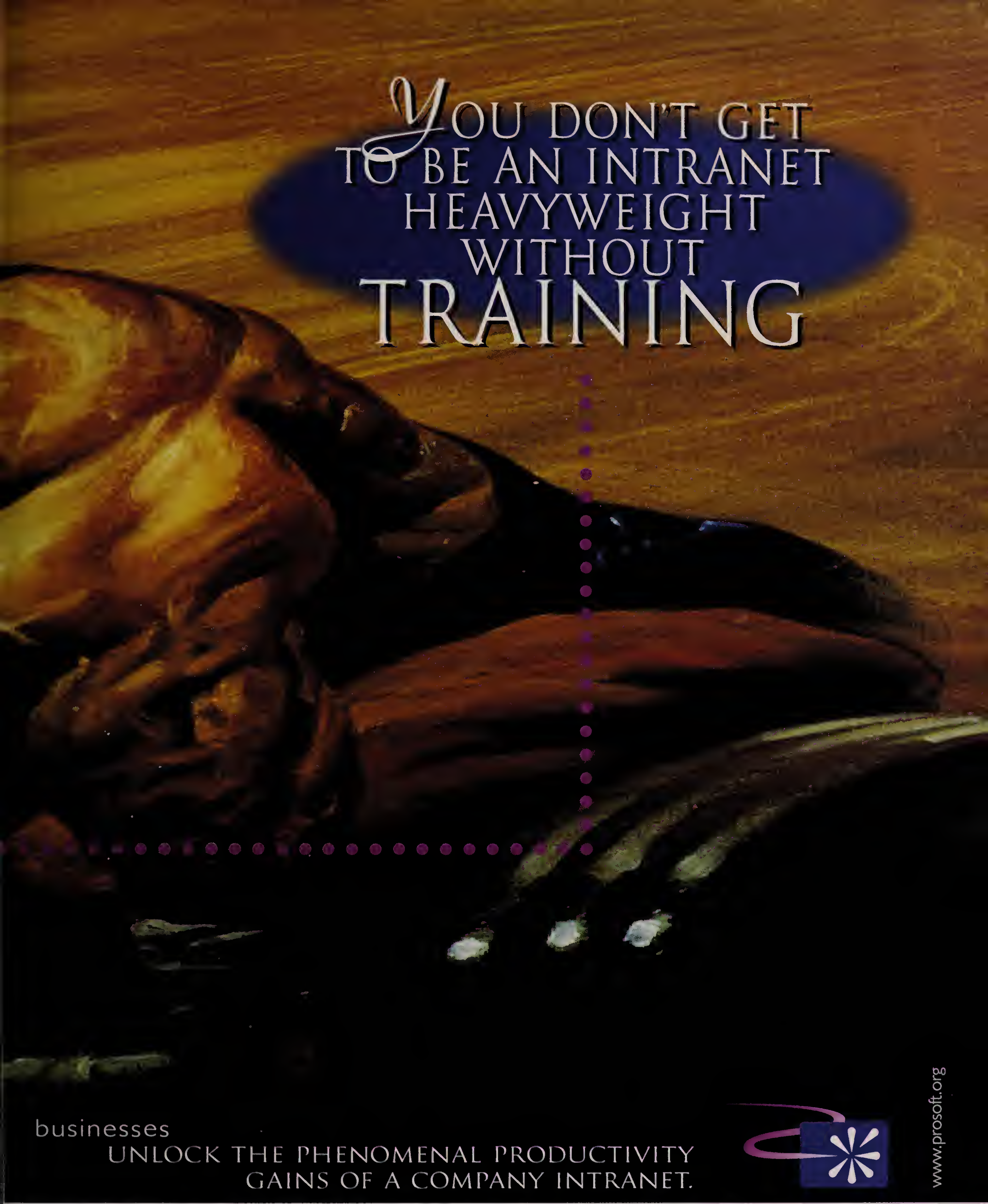
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so made of reusable components).

Business components are more likely than other components to be developed in-house, where standards that make reusability possible are easier to establish. Those components embody proprietary business rules such as how to determine how much credit to extend to a new customer, when to apply interest charges to late payments and how to calculate interest.

THE TECHNOLOGY OF CBD

One of the two key requirements of component-based development is an open interface that allows components to communicate. Components that work together must know quite a bit about each other: how each works, what data each needs, what formats the data uses, what commands each component knows and how each will respond to them. That kind of compatibility requires an agreement among vendors. At this writing, a consortium of vendors including Hewlett-Packard Co., Microsoft Corp., Oracle Corp. and Texas Instruments Inc. is scheduled to submit a proposal that specifies the description of component interfaces to the Object Management Group, an industry organization in Framingham, Mass. Acceptance by the OMG is anticipated by the second quarter of 1997.

While souped-up repositories are coming in the near future, most development shops have at least one application modeling tool that might be pressed into immediate service.

The second requirement of component-based development is a component repository, a place to store information about a company's components, that also links to the components themselves (see "Once Is Not Enough," Page 28). While souped-up repositories are coming in the near future, most development shops now have at least one application modeling tool (which used to be called a computer-aided software engineering, or CASE, tool)

CORBA
Common Object Request Broker Architecture. A messaging standard that enables object-oriented systems to interoperate.

Encapsulation
The isolation of a component's attributes and behaviors from surrounding structures. The technique protects components from outside interference and protects other components from relying on information that may change over time. Components are often encapsulated.

Event-driven programming
The technique of creating applications in which the order of actions is determined by the end user or an external event as opposed to the programmer. The opposite of procedure-oriented programming.

Inheritance
The mechanism for sharing behaviors and attributes among objects. Behaviors and attributes defined at a higher (more abstract) level can be accessed or redefined at a lower (more concrete) level. Some components are capable of inheritance.

Iterative development
An approach to application development in which prototypes are continually refined into increasingly complete and correct systems. (*See* prototyping.)

Module
A unit of software code designed for use with other modules; a component. (*See* applet.)

Object
A software module containing a collection of related data and procedures for operating on that data. (*See* business object.)

Object orientation
An application development and database technology based on defining abstractions of real-world entities known as objects, such as invoices, orders and customers, which contain both data and procedures. Key characteristics of object-oriented systems are encapsulation, inheritance and polymorphism.

Polymorphism
The ability of objects to handle different types of information and different requests for actions. Components are not typically polymorphic.

Procedure-oriented programming
The traditional approach to application development, in which the sequence of actions is determined by the programmer rather than the end user or another application. The opposite of event-driven programming.

(Continued)

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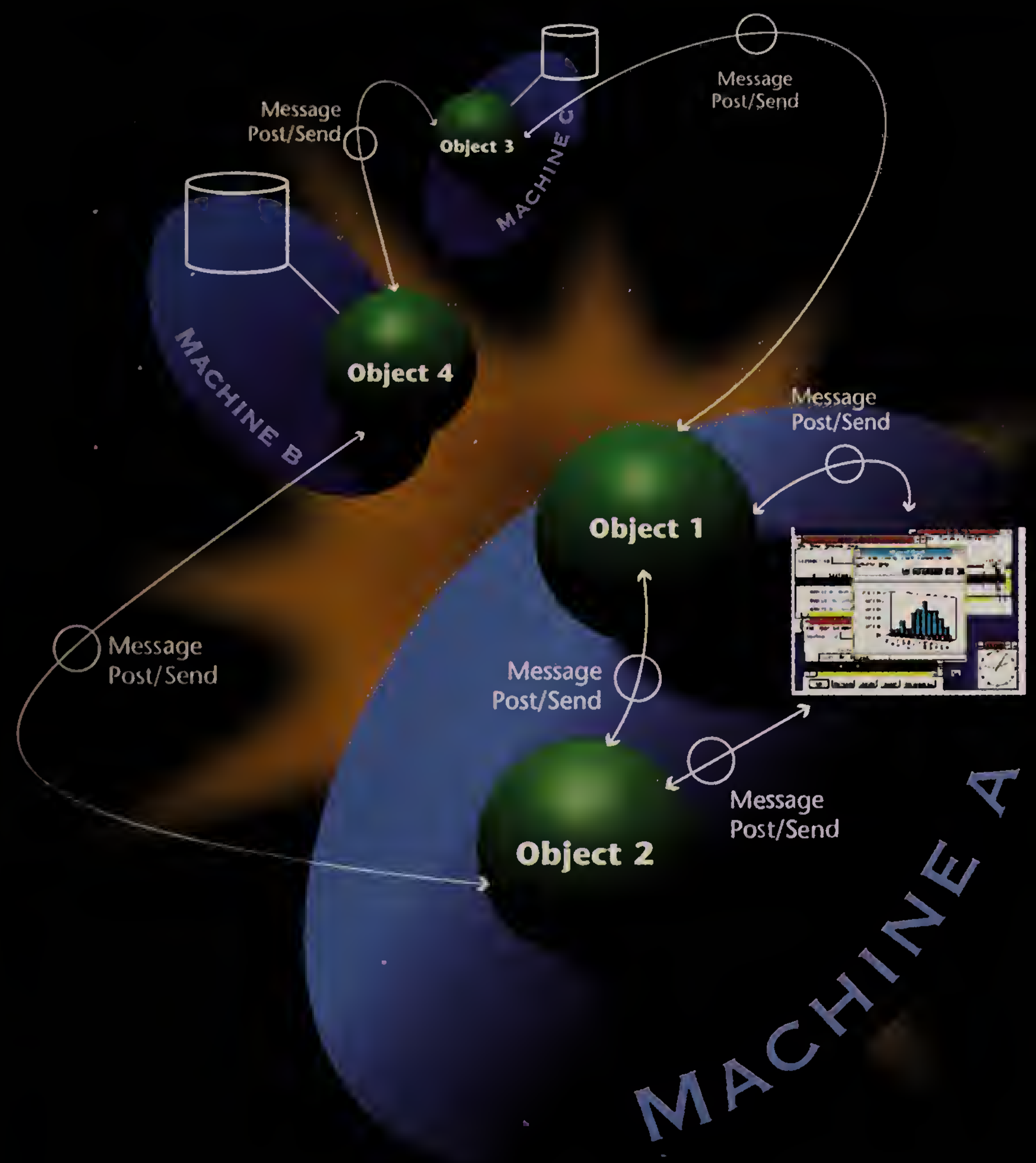

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equipped with a repository that might be used to handle component descriptions. Even a rudimentary repository that can do little more than report on the component's name, its physical location on the server, its purpose, data types and the instructions it can understand is an acceptable starting place. Software configuration-management tools—often present on a shelf if not in use at most IS organizations—can usually manage the same kind of information. Insiders say Microsoft will release a dedicated component repository at about the time the Object Management Group approves the standard component definition. That repository will be applicable only to Microsoft environments, but other platform-independent applications are in the pipeline.

Corporations using intranets now have a head start on providing developers with enterprisewide access to a repository.

Corporations using intranets now have a head start on providing developers with enterprisewide access to a repository. Application developers will be able to log onto a Web server, search for a component by typing part of a key word and retrieve a list of relevant components, including each item's description and documentation. The intranet's graphical capabilities will make it possible for the programmer not only to read about the component but also to see it—particularly in the case of a user-interface element. Then, with a simple mouse click, the desired component can be downloaded from the server to the developer's client machine to be incorporated in the new application.

Of course, repositories do not build themselves. Developers must be encouraged to build components to populate the repository, and most organizations will need to designate a repository manager or librarian. There may already be such a person in charge of Cobol libraries. Both the person and the Cobol modules may be integrated into the component repository effort.

Contributing Editor Miryam Williamson can be reached at mwilliamson@reporters.net.

Prototyping
The development of a model that displays the appearance and behavior (look and feel) of an application to be built. A prototype may only demonstrate the application's appearance. It may also demonstrate navigation and user controls, or it may even accept input data that can be stored in and retrieved from a simulated database. (*See* also iterative development.)

Repository
A database of information about objects and components. Synonyms include library and encyclopedia.

Reusability
The characteristic of a component that allows it to be used in more than the application for which it was created, with or without modification.

Spiral life cycle
Another term used to describe the iterative development process. Opposite of waterfall life cycle.

Waterfall life cycle
The conventional software development process, consisting of a series of steps commonly defined as analysis, design, construction, testing and implementation. The underlying assumption is that each phase does not begin until the preceding phase is complete.

Gauging Results

Knowing what to measure is as important as knowing what metrics to use

Functionality:
number of inputs, queries, outputs, views of data and interfaces to external systems, rated according to complexity

Duration:
in calendar weeks or months

Effort:
in workweeks, months or years

Usability:
number and frequency of help-desk calls after delivery

Suitability:
number of change requests after delivery

Errors:
per *n* lines of code (excluding blanks and comments)

Time to Fix:
average turnaround time from bug report to delivery of fixed code

Reuse Ratio:
lines of code reused per total lines of code

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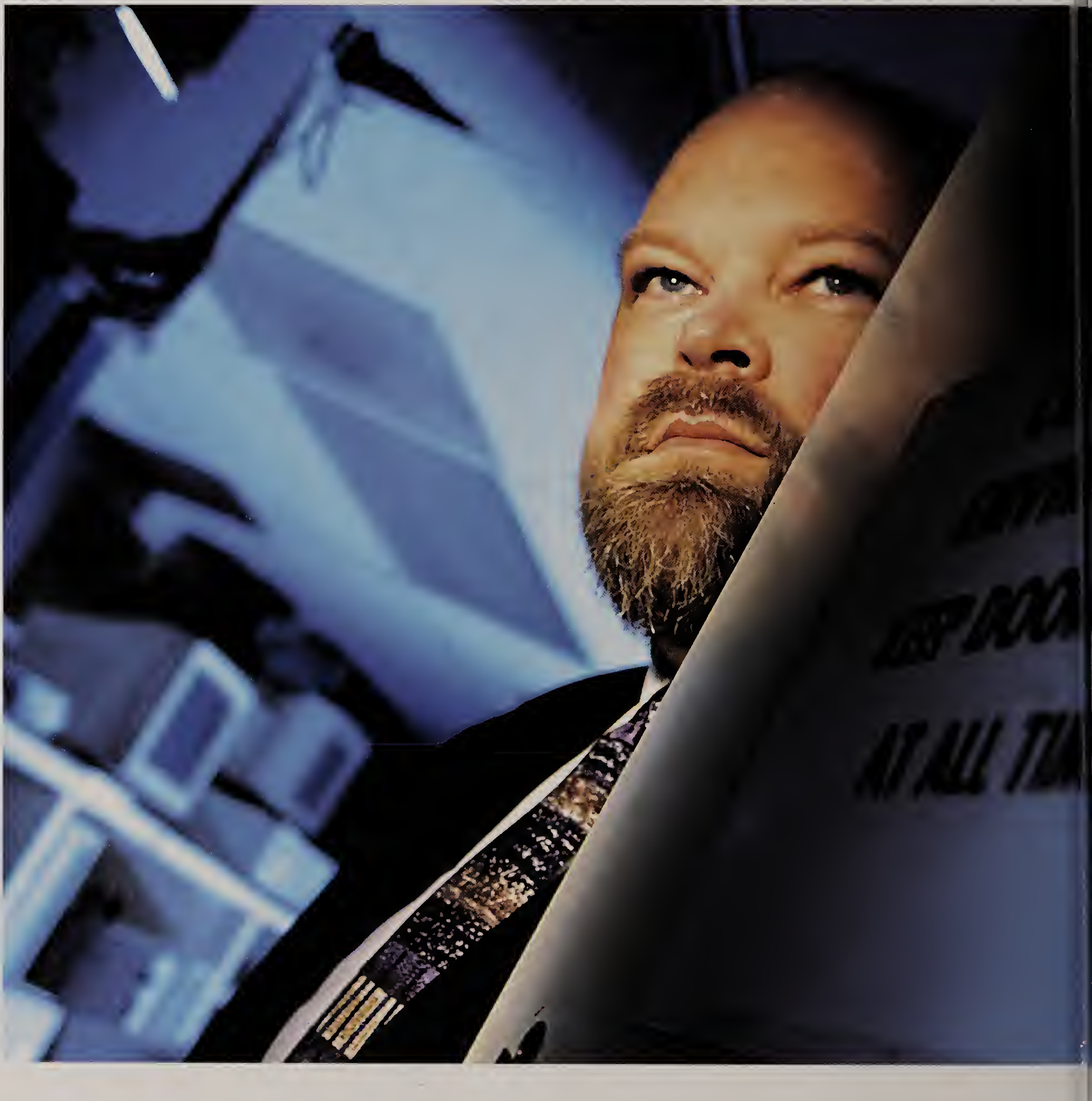

Thief...

Bill Hancock: *"A lot of things CIOs think give them security actually don't."*

...sometimes you need to hire one. Security veteran Bill Hancock helps CIOs safeguard company secrets by finding loopholes in networks, firewalls and building security.

BY JENNIFER BRESNAHAN

CIOS MIGHT GET A LITTLE NERVOUS when Bill Hancock shows up for a visit. Hancock, a 25-year network and system security veteran, is paid to find what the CIO is missing—failed passwords, lax security guards, even improperly latched windows—anything that constitutes a security lapse. He steals hardware and infiltrates systems whenever possible, leaving stuffed Garfield cats in his wake to show where he could have planted a bomb or logged onto the network without authorization.

Hancock's profession may be unusual, but clients of the New York-based consultancy Network-1 Software and Technology Inc., where he is executive vice president and CTO, are grateful to have him prowling on their behalf. Even a careful company likely will overlook something—there's just too much to track, what with hackers, new technologies and an increasing number of telecommuters. And there's more to security than just preventing network break-ins and information theft. Companies can also be slapped with fines (and senior executives can get jail time) if they unwittingly run afoul of laws designed to safeguard intellectual property and protect other organizations from security breaches.

Staff Writer Jennifer Bresnahan recently spoke with Hancock, an author of more than 24 books on network security, about what CIOs need to know to stay out of trouble.

PHOTOGRAPHY BY KATHERINE LAMBERT

CIO: *Do most CIOs have a false sense of security when it comes to, well, security?*

Hancock: A lot of the things CIOs think give them security actually don't. They may have purchased the right software and hardware, but users turn the stuff off. For example, in most operating systems like NT and VMS, there's what's called a C2 certification, which requires dual passwords. [To earn C2 certification, vendors must incorporate certain security facilities, such as access control lists, into their products.] Sounds great, but to be C2 compliant, you have to have that second password enabled. The problem is, if you turn on the second password you can't run certain programs. So people turn it off, which weakens security dramatically. It's like the seat belts in a car: Theoretically they make a car safer, but they only work if people actually use them.

CIO: *Typically, how big are the security holes in companies that think they're covered?*

Hancock: Well, last year we did a security study on a very large bank in New York. This is what we call an active, "friendly" penetration study, or an "ethical break-in" effort. We do not break into anything without permission in writing from the customer. The day before we were supposed to do this, I went down there, looked around for 10 minutes and saw that their security badges were just a white background with a picture, name and the company logo in blue across the top. Very simple. I used my portable computer and Avery LabelPro to create a badge that looked identical. I got their logo off their Web site and just pasted it in. A piece of black tape across the back looked like one of those magnetic strips. Whenever I had to use my card to get in somewhere I just said it didn't work, and somebody was always nice enough to let me in. I made it all the way down to the computer room. When I got there I told the people there was a security test going on and they left. I locked the doors and nobody could get in.

Eighty percent of all computer break-ins are inside jobs.

On the Safe Side

Tips to keep your company's systems out of harm's way:

- **UNDERSTAND THE STRATEGIC security requirements for your company. What is important and what are the risks? What would prevent the company from doing business?**
- **KNOW WHICH ASSETS you're trying to protect.**
- **UNDERSTAND THE LEGAL RAMIFICATIONS of security decisions you make.**
- **ESTABLISH A WAY TO ENFORCE policies and procedures to let employees know you mean business.**
- **RUN BACKGROUND AND REFERENCE CHECKS on the people charged with implementing your security to make sure they are trustworthy.**
- **UNDERSTAND CONTRACTUAL OBLIGATIONS and nondisclosure agreements with any vendors or customers. Where are your liabilities and what are your safeguards?**
- **SAVE ONLY THE E-MAIL AND OTHER documentation that you need and destroy the rest.**

Another of my favorite stunts is showing companies the risk of having network connections for employee presentations in public places like the cafeteria. Now, common sense says if you have public network connections, you should disable them until you need them. Well, many people don't do that. So I plug in my laptop in the cafeteria, use a standard protocol analyzer and manage to snag all the system manager's password software because I've got a filter written to do exactly that. Thirty minutes later I have the system manager's password and I'm able to log into anything.

CIO: *How big a problem are these types of internal breaches for companies? And how can CIOs avoid them?*

Hancock: In 1991 the FBI released a report that showed that 80 percent of all computer break-ins were inside jobs. A lot of people think encryption is a catch-all for security. Boy, is that wrong, because internal hackers have the encryption keys. Encryption means you've got a tunnel between yourself and the remote site. But it doesn't prevent someone from doing whatever they want once they get in. Security via encryption is not enough. There has to be something else that says, "Bill has the right key but he's still not allowed to get into certain areas." The CIO needs to make strategic decisions that some things should never, ever be accessible from the outside, no matter who's logging in.

CIO: *Most CIOs are aware that telecommuting involves serious security risks. But is there anything about protecting an extended network that even security-conscious CIOs might not know?*

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Hancock: The newest risk is the expanded security parameter. [Tele-Communications Inc.] offers its @Home service for commercial use in Fremont, Calif., and Hartford, Conn. If you live in these places you can connect to the cable TV network as an Ethernet node from your home. With that you bring up TCP/IP and boom, out you go It's a high-speed connection that's just like your Ethernet in the office. The catch is you're now on a public, not a private, Ethernet. Anybody else out there with the right software can see what you're doing. If the CIO doesn't do something about securing that home system—and I'm not just talking about encryption, I mean a firewall or something along those lines—then all of a sudden people can attack the network through the home system.

CIO: *What do CIOs need to know about the laws governing security?*

Hancock: CIOs should realize that the very laws designed to ensure security can wind up costing them money and, in some cases, result in misdemeanor and felony charges. For example, there are laws on the books banning the export of chemical, biological, encryption or other technology to certain countries or individuals on a restricted expert list. Some of these people are U.S. citizens who, for whatever reason, the Department of Commerce or Department of Defense has deemed untrustworthy. But most companies wouldn't think twice about shipping something to a U.S. address or sending e-mail. Not realizing that the list exists—and most companies don't—can lead to problems down the road.

CIO: *What were these laws designed to prevent or protect?*

Hancock: The U.S. government views encryption as a national security asset. If we were to put encryption in a product and our enemies like Iraq were to get a hold of it, the U.S. government would have a heck of a time finding out what they were up to. The problem is, export controls touch our friends as well as our enemies.

CIO: *Do you know of companies that have been tripped up by this law?*

Hancock: One of our customers is a very large pharmaceutical company that was recently purchased by a German company. Like most pharmaceuticals, our client had developed a very large database of all its compounds, chemicals and product formulas. It turns out the German company and its scientists weren't allowed to view the database, even though they bought the company and all its assets, because of export restrictions on technology and biochemistry. The CIO had no knowledge of this. So we went over to a law library and pulled up the information, and there it was in black and white. Without an export license, his company would've been fined at least $50,000 per occurrence, or five times the actual value of the product.

In some cases, violating security laws can result in felony charges against a CIO.

In a now-famous incident, a computer vendor was fined over $8 million in 1991 for disclosing restricted processor technology to countries banned by the Department of Commerce. In fact, the incident was that a data sheet and detailed technical specifications on a new processor were sent out in a worldwide e-mail notice to the vendor's offices and third-party customers. The vendor didn't have an export license, so he was found guilty, fined and warned that further violations could result in the shutting down of all international telecommunications links. If this had happened, the vendor would've had to file Chapter 11 bankruptcy within 30 days due to the amount of overseas business the vendor conducts.

CIO: *Does doing business internationally bring up any unique security risks?*

Hancock: When moving data internationally, a lot of additional laws kick in. The United Kingdom is a good example. Their copyright law, passed in the 1989 Data Security Act, says that if one of your employees is caught running an unlicensed version of software—let's say she installed a Microsoft Works CD on her machine without having a license for it—then you, her manager, could be fined up to £5,000 [just over $8,000]. And you might even be subject to five years in jail.

CIO: *So how can CIOs help their companies handle the myriad risks?*

Hancock: It is no different than the effort involved for an accountant to keep up with tax law. It's not just going to happen. What most people don't realize is that computer security is a body count problem and requires technical expertise in both security and law. CIOs should think about having a security audit by certified security professionals like the people at the Information Systems Audit and Control Association. They should also look at retaining a high-tech law firm.

If a company outsources security, the vendor better be doing these things; the CIO better make sure it's in the contract. CIO

Staff Writer Jennifer Bresnahan can be reached at jennifer@cio.com.

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Beyond Client/Server

Are Web-based applications "client/server done right"?

BY CURTIS F. FRANKLIN JR.

ILLUSTRATION BY JIM SCHERER

FOR YEARS, DENVER-BASED telephone company US West Communications instructed its 6,000 customer service representatives to tell customers that installation of any new service would take approximately 48 hours. Eventually, with the rise in multiline residential installations and the boom in construction throughout the company's service area, representatives found it difficult to determine just when new services could be completed. The standard answer just didn't cut it anymore.

The frustrating reality was that the information for accurate time estimates for customer service did exist—the operators just couldn't get to it, according to David Laube, vice president and CIO at US West. Laube's solution? Build a Web-based front end for the customer service desk. "With the customer on the phone, the representative can now have the application launch a search engine, find the information and drop it back on the operator's desk in realtime," he explains.

Browser technology was crucial to the project's success, Laube says, because it allowed the company to build and deploy in eight weeks an application that had eluded its developers for 10 years. By putting that information on the service representatives' desktops, they could give customers an accurate time commitment for service.

Part of the payoff came by way of more satisfied customers and happier shareholders. In addition, "that application alone saved us $10 million in the first year," says Laube.

Applications that divide processing requirements between server and workstation aren't new, but the rapid development and deployment of the World Wide Web and its essential client software, the Web browser, are leading many organizations to experiment with the technology for all types of applications. In fact, some are beginning to question whether applications based on browser technology are the ultimate expression of the client/server model. Somewhere between the hype of the Web and the caution of technology traditionalists lies an intriguing approach to faster, lower-cost development.

IN THIS SECTION

- Smart Cards
- Automated Voice Services
- Rugged Notebooks
- Seamless Communications

Why the Rush to the Web?

It started in 1984 when Apple Computer Inc.'s Macintosh introduced the concept of a GUI to the mainstream computing world. GUI designs for MS-DOS, Unix and other platforms followed, and the platform wars were on. Corporate IT executives have found themselves caught in the crossfire ever since, forced to mediate between fans of one GUI or another. As if that weren't enough, many IT

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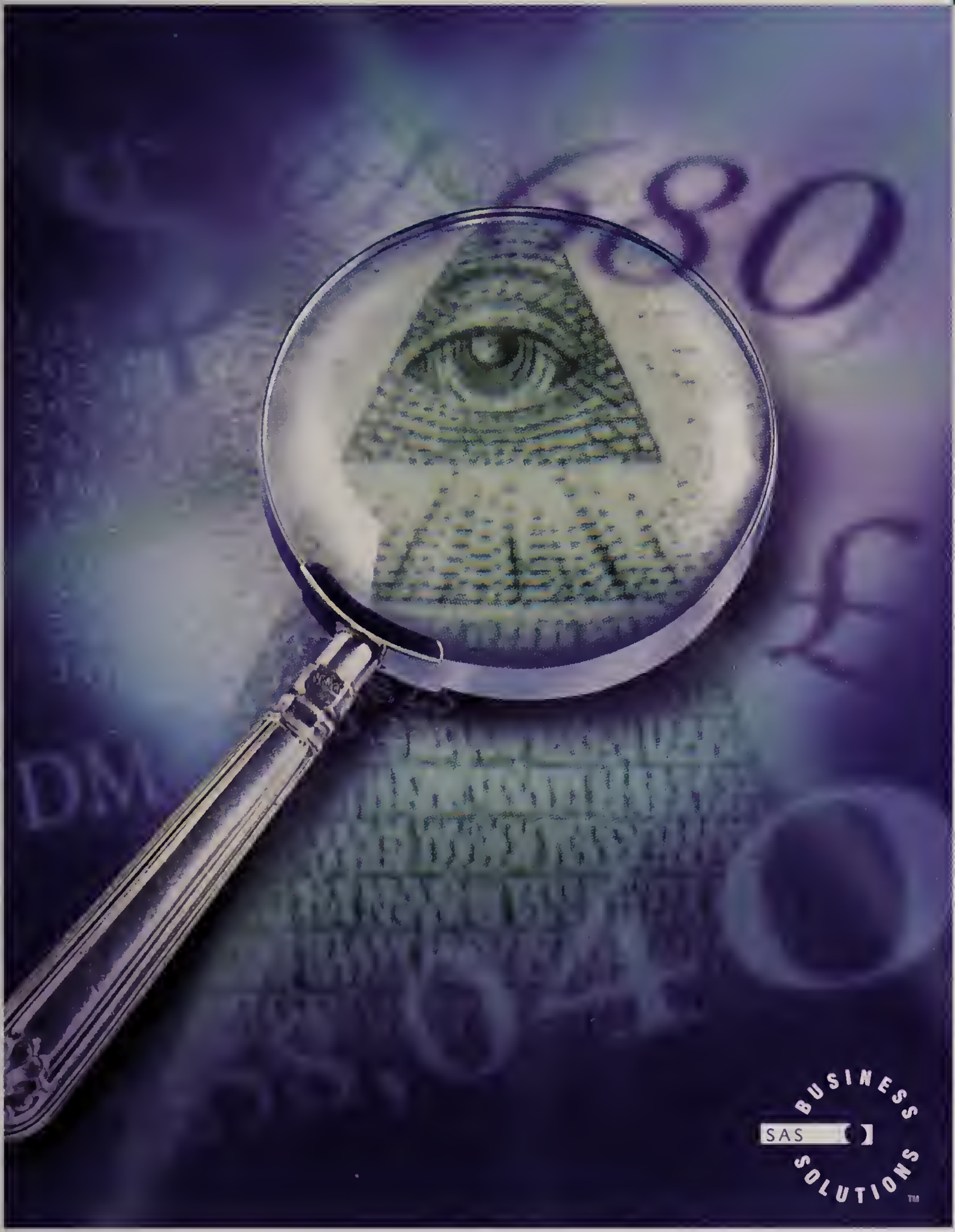

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departments have been required to support multiple GUIs, enormously complicating support and development issues. So it's no wonder that many are intrigued by one of the principal claims of browser enthusiasts: platform independence. Because the browser creates a self-contained graphical world, and because all browsers for all platforms understand the same set of instructions, the development staff can blithely ignore the operating system that exists on the client computers. At least that's the theory.

While many consider Web-based applications to be an extension of the client/server model, in one crucial way they are a dramatic departure: Virtually all business-rule processing occurs on the server, not on the client. The client systems do all the display work, providing the GUI that has become so necessary for modern computer applications. But the database, query engines and business-process servers sit at the center of the enterprise rather than being distributed to the desktops. Perhaps surprisingly for those reared in the true religion of client/server, Web enthusiasts view that thin-client model as a benefit.

In the classic client/server model, developers have to concern themselves with separate pieces of application software at the client and the server (and often at several points in between). In the Web-based world, however, the client displays whatever is sent to it over the network. To change what the user sees, one need simply change the Web page file; in the eyes of the user, a new application is loaded each time he or she logs in. Developers don't have to worry about keeping versions of client and server software in synch or if a new version of the client software can actually communicate with the server.

As an additional benefit, new versions of applications can be deployed almost instantly by simply changing the information sent by the Web server. The savings in both time and support costs can be significant and creates a major driving force in favor of Web-based applications.

Software savings are not the only economic factors weighing in for browsers. Because practically all business-rule processing takes place on the server, workstations may no longer require the massive computing power and storage systems now common on high-end desktop systems. Whether corporations and their users will, in fact, be willing to trade the individual power and flexibility of current desktops for the lower cost and built-in manageability of a system built around a browser remains to be seen. A growing number of organizations are looking at these browser-based systems, called network computers, as a way of reducing the high support and implementation costs that have characterized the personal computer era.

Smart Money

Convenience and security are only the beginning of what smart-card technology promises

The rise of Internet commerce and a resulting increased interest in secure financial transactions are helping to raise the profile of processor-based smart-card technology.

Comparable in size to a conventional magnetic-strip credit card, smart cards are intelligent devices that feature a wide range of transaction, security and portable information storage capabilities.

SMART CARDS

On the World Wide Web, smart cards could be used to safeguard confidential financial information and store digital cash. Hoping to transform the concept into a reality is London-based Mondex International Ltd., an international consortium backed, in part, by MasterCard International Inc.

Under the Mondex plan, now being organized by Mondex USA in San Francisco, Net surfers will be able to store digital cash on a smart card, which can then be used to make inexpensive online purchases from Web merchants. Consumers will load digital cash onto their cards via their Net-linked PC or from public locations such as automated teller machines.

Chris Goeltner, manager of North American smart-card chip operations for Siemens Corp. in Cupertino, Calif., envisions the day when every desktop computer keyboard comes equipped with a smart-card reader. "Card-reader technology will be several dimensions more secure than any currently used encryption technology," he says. "It will be functionally the equivalent to using a credit card in a store." Key Tronic Corp., Alps Electric Co. (of Japan) and Hewlett-Packard Co. are among the companies that are developing, or have developed, smart-card reader-equipped keyboards.

Smart cards are also set to play a role in the emerging world of corporate intranets. The technology can be used to bolster the security of in-house networks based on Internet technology, says B. Jeffrey Katz, vice president of marketing at Atmel, a San Jose, Calif., semiconductor manufacturer. "Managers can issue cards and PINs to give authorized users intranet access," he notes. Katz adds that smart cards can incorporate personal biometric information from retina and fingerprint readers, making authentication virtually ironclad.

Cyberspace smart-card applications will likely play a significant role in spurring smart-card production. Market researcher Dataquest expects worldwide shipments to jump from 156 million units in 1996 to 1.2 billion units in 2001. *–John Edwards*

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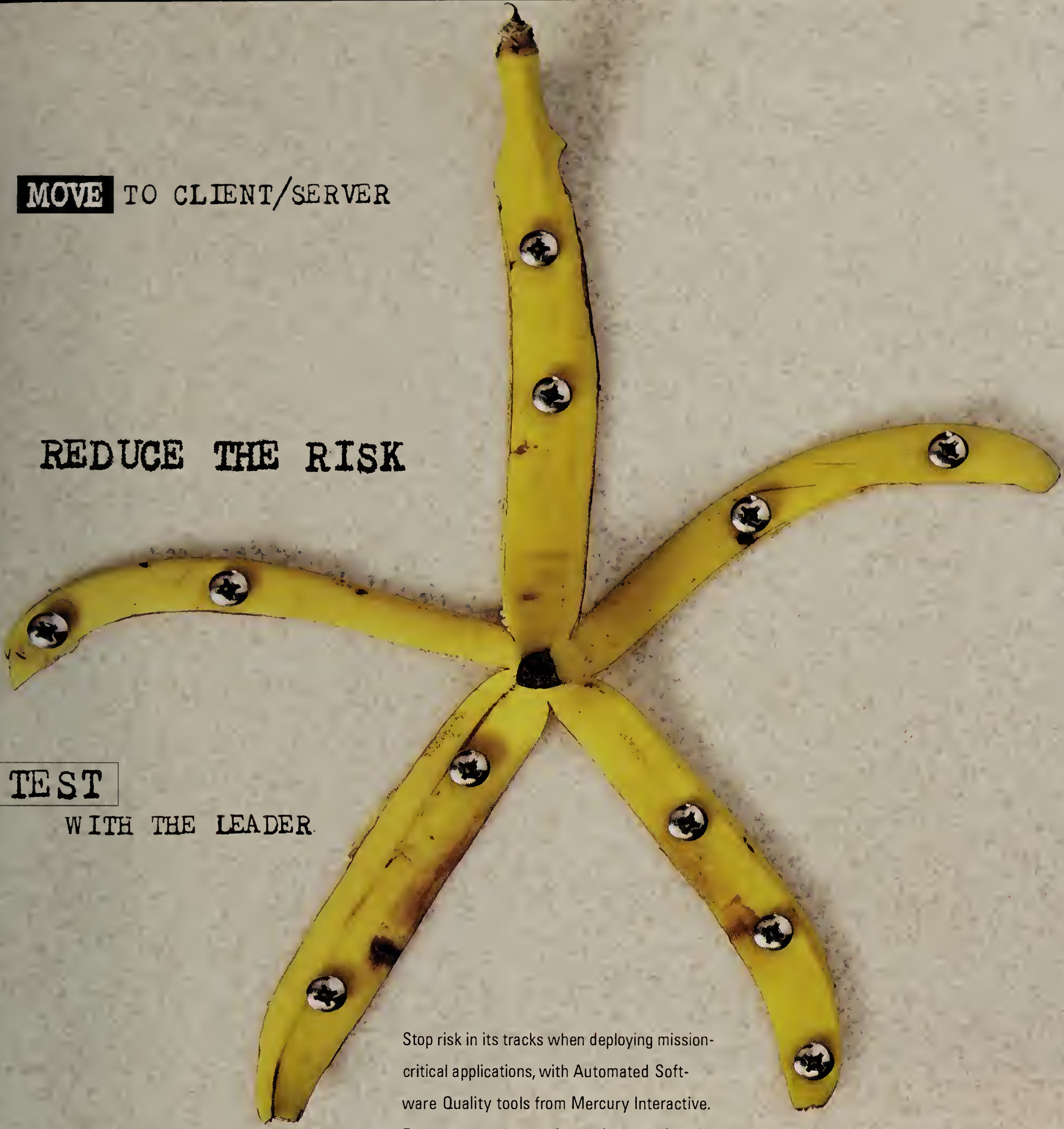

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Making Client/Server Work

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Emerging Technology

Although most media attention is focused on the brave new applications being created with Web technology, the most exciting news for many IT professionals may be the extended life that browsers can offer to legacy applications and data.

"There are three significant problems facing legacy systems that a Web front end helps solve," says US West's Laube. "They're hard to change. They have rigid user interfaces. And they're hard to get to," he explains. "So we're replacing the rigid user interface of legacy systems with Web front ends and turning the legacy systems into data and business-rule servers."

The independence of the client platform that so liberates some Web application developers can bring sleepless nights to others. "You're never quite sure of what's going to happen at the client end," says John Hulson, manager of the digital lab at Discovery Communications Inc. "We try to get around that by putting as much as possible on the server," he says.

> **"There are significant problems facing legacy systems that a Web front end helps solve."**
> *–David Laube*

His concern centers on the fact that, although the basic commands for displaying text in a Web page are standardized, the commands for going beyond the basics are anything but standard. Though additional features for Web pages can increase the number of functions those pages can carry out, they also up the ante of requirements on the browser side. Those technologies include Java and ActiveX, which create "applets" that run on the client and thereby shift some of the processing load off the server; frames, an HTML technology that divides a user's screen into multiple active areas that can display separate functions; and multimedia add-ons for adding sound, video and other media to the page. New technology from Microsoft Corp. promises to let the server discern the capabilities of the client and serve up appropriate pages, but, for now, designing to the "lowest common denominator" of features is the safest course.

Continuing to develop with traditional tools while exploring the possibilities of browser-based technology is a path followed by much of the industry. Laube has overseen the development of both browser-based and more traditional client/server applications over the last two years and anticipates his organization will continue to develop both types of applications for the foreseeable future.

A Question of Bandwidth

Even the proponents of browser-based technology for client/server applications recognize that there are still a few hurdles to overcome before proprietary development tools can be relegated to the dustbin of history. While it might seem that each manager would have a unique list of issues, a few problems are common to most lists. Among them are slow application response times, a scarcity of production-quality development tools and a lack of security features. Response time is especially critical if

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'Til Convergence Comes

AUTOMATED VOICE SYSTEMS WORK BEST FOR high-volume, low-priced consumer products where profit margins are narrow. Softbank Services Group's **Tel-Address**, a suite of automated voice technologies, is designed to process any kind of customer order directly over the telephone. It is especially suited to high-volume purchases such as entertainment software, product upgrades, maintenance contracts, product registrations and periodical subscriptions.

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Tel-Address's speed and accuracy come from integrating powerful databases and automated data-capture technology with Softbank's back-end order-processing and fulfillment infrastructure. The company has plans to handle more than 12.5 million customer calls within the United States in 1997; its statistics show that the new service method can cut the cost of agent-assisted systems by up to 75 percent.

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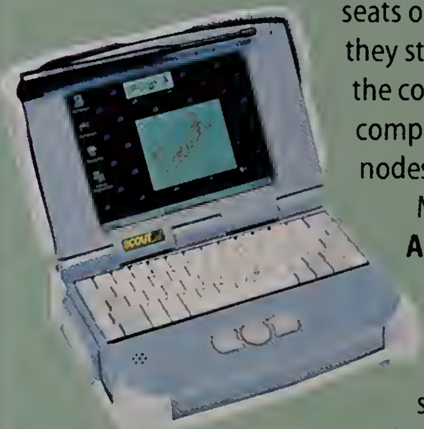

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your organization processes transactions worth millions of dollars per minute. As director of operations for Nasdaq Stock Market Inc. in Washington, John Delta is responsible for just such a system. While he oversees the development of a number of browser-based applications, Delta is blunt about his view of the technology's performance. "The response time [for a browser application] is unacceptable for a true client/server application," he says. "People building Web sites for client/server applications need to look at ways to optimize response times."

In general, performance issues boil down to problems matching the amount of graphical information to be sent to the client and the available bandwidth between client and server. Laube admits that one reason he still supports the development of some applications using traditional client/server tools is because of the crucial requirement for high performance in enterprise client/server applications. "When you're running gigantic numbers of transactions through the system, it's got to be fast," he says.

Yet, as significant as the issue of performance is, some say it is not the most important consideration. Ensuring that only authorized users can conduct transactions is critical to any application built with so open a tool as a browser. That very openness works against the designer in building a secure application, according to Nasdaq's Delta. Because of the huge dollar volume that flows through the Nasdaq systems, Delta is more concerned with security issues than the average technologist might be. "The trading system is our lifeblood, and I don't think the issue of security has been worked out to the satisfaction of an organization such as ours," Delta says.

The basic architecture of browsers works against good security, says Peter Heller, director of business development at Oracle Corp. in Redwood Shores, Calif. "If you were going to take your standard applications and port them to browsers, the security model would be all wrong," says Heller. As one of the key difficulties to be overcome, he points to a focus on open access and an architecture that is designed to be "stateless"—that is, an architecture that assumes any user can go directly to any file at any time regardless of program sequence. Heller assumes, as do most people, that the security issues will eventually be overcome.

A third major hurdle for browser-based client/server developers is a shortage of serious, business-focused development tools. "If you're going to do high-end client/server financial applications, you'll have to write custom code," admits Delta.

"Just around the corner" describes the hopes of many observers as they look at the possibility of moving all client/server development to a browser basis. Larry Weber, vice president and general manager of the Developer Products Group at Sun Microsystems Inc. in Mountain View, Calif., anticipates that, within three years, the majority of development in client/server will have moved to a browser-based front end. "It's amazing how rapidly people are moving to a browser front end," says Weber. "I think this will be the most rapid change the industry has ever seen."

Curtis F. Franklin Jr. is director of Client/Server Labs in Atlanta and a freelance writer. He can be reached via e-mail at cfranklin@cslinc.com.

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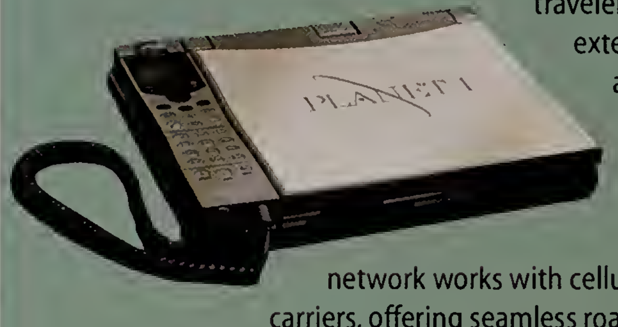

Lightweight and portable, the phone expands the information skyway, making information transmission easier and cheaper than other methods; eventually, the system may turn into a wireless network of public information that brings the power of communications technologies down to a personal, voice-to-voice level.

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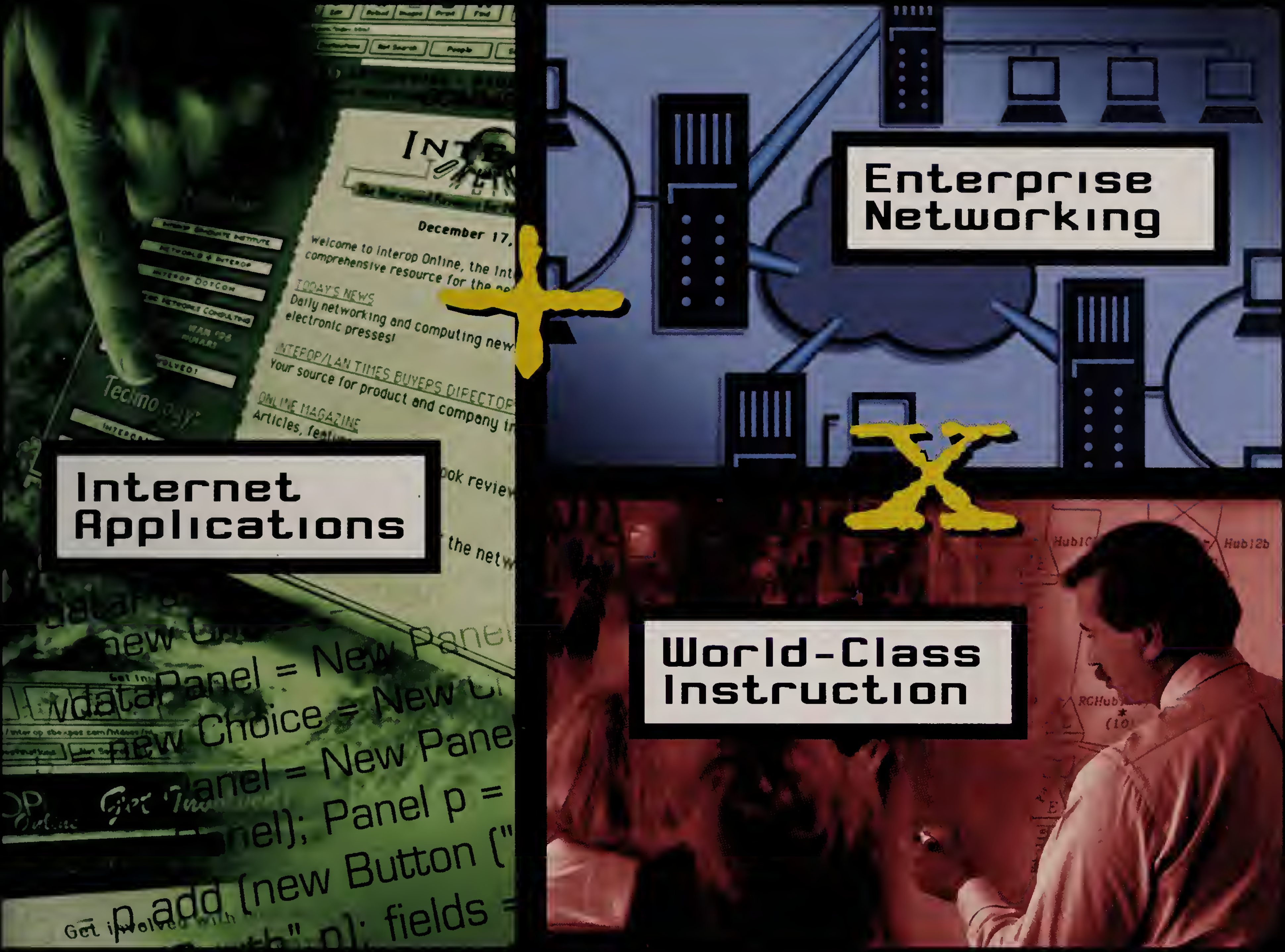

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Working Smart

MAXIMIZING THE PAYOFF FROM INFORMATION TECHNOLOGY

Clawson Concrete's Fleet-Tracking System

Vital Statistics:

- **Organization:** Clawson Concrete Co., Novi, Mich.
- **Application:** Fleet-tracking and communication system
- **Technologies:** Messaging software from Alkon; vehicle-status tracking equipment from VehiCom; Ameritech CDPD network; Advanced Systems Group International Inc. sold the GPS systems to Clawson and integrated it with the Alkon software in each truck
- **Scope:** Fleet of 100 trucks operated by approximately five dispatchers and 75 drivers
- **Sponsors:** Pat Nielio, formerly vice president of operations and now director of technical services at Clawson's parent company, Edw. C. Levy Co.
- **Objective:** Reduce delivery time and product loss
- **Payoff:** Increased delivery rate and accuracy; improved customer service

TALK ABOUT a perishable product line: Cement starts hardening the moment it is mixed with water. For Clawson Concrete Co., based in Novi, Mich., that translates into a 90-minute window of opportunity to get each truckload of cement to a customer site and unload it before the agitation of the rotating drum breaks down the cohesive strength of the product. After the 90-minute mark, a building inspector is likely to reject the load, which chips away at Clawson's profits. To add insult to injury, the driver must then head back to the plant to have the hardened concrete jackhammered out of the truck. With timely product delivery at a premium, Clawson replaced its outdated two-way radio delivery-truck dispatch technology with a cellular-based tracking and routing system. The changeover has yielded hard benefits, including improved accuracy and decreased waste in product delivery.

Clawson serves the greater Detroit area with seven ready-mix plants and a 100-truck delivery fleet. When a dispatcher receives a new order, he must decide which plant the delivery should come from and what truck to put it on. Two years ago, that process hit a stumbling block. The two-way radio system that transmitted those messages became overcrowded; in some cases, a signal took 20 minutes to arrive at the central computer, which often meant an idle 20 minutes for a delivery truck back at the Clawson plant. It also meant the dispatch system was receiving inaccurate data regarding the travel time to and from the job site. As a result, subsequent deliveries to the same area would arrive too early or too late, endangering the integrity of the product.

When Pat Nielio arrived at Clawson as vice president of operations in 1995, fixing the problem became his responsibility. Nielio's solution started with junking the radio-based system in favor of a wireless cellular digital packet data (CDPD) network, managed by Ameritech Cellular Services, for signal transmission.

Today, the dispatch process is streamlined by an Alkon dispatch system that tracks delivery times from each plant to every part of the Detroit area Clawson serves. To keep tabs on which trucks are available at a given moment, drivers punch a control-box indicator at each stage of a job, informing the dispatcher when they finish loading, leave the plant, arrive at a delivery site and so on. Job-status data signals now move by CDPD to Ameritech's towers, which then are transmitted to Clawson headquarters via an Ethernet land line. Clawson initiated a 10-unit pilot to test the system's capabilities without breaking the bank. The results were persuasive: One hundred percent of the signals took less than a half-second to get from the trucks to the central system. The Alkon dispatch system uses historical data to continually learn new delivery times, says Nielio. Under the old system, such data was corrupt because of transmission delays. "Now we're getting accurate data," he says.

Halfway into the project, Clawson decided to expand the system's capabilities by installing global positioning system (GPS) units in the trucks. The GPS allows dispatchers to pinpoint any truck's whereabouts, down to the street level—a practice that saves truckers time and the company money. "If we're late, that means the contractor has six guys twiddling their thumbs at $30 an hour each," says Nielio.

Linking the technologies with Alkon's central dispatch system proved tricky because the CDPD network had to carry both the GPS data signals and the job-status data. Nielio says opportunity's knock kept all the vendors working together. "They all saw this as an emerging technology and wanted to be in the loop, he says. Clawson completed the rollout by August '96, about one year after planning started. (Nielio is now at Clawson's parent company, Edw. C. Levy Co., in Detroit.)

The company measures its productivity gains in cubic yards per delivery hour—calculated by dividing the total yards of concrete delivered by the hours paid for delivery drivers. The new system upped Clawson's bottom line by two-tenths of a cubic yard per hour. While the delivery cost is a competitive secret, Nielio says the system paid for itself in less than six months.

–Derek Slater

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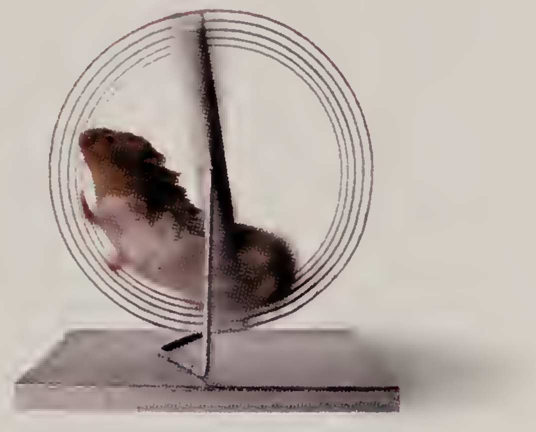

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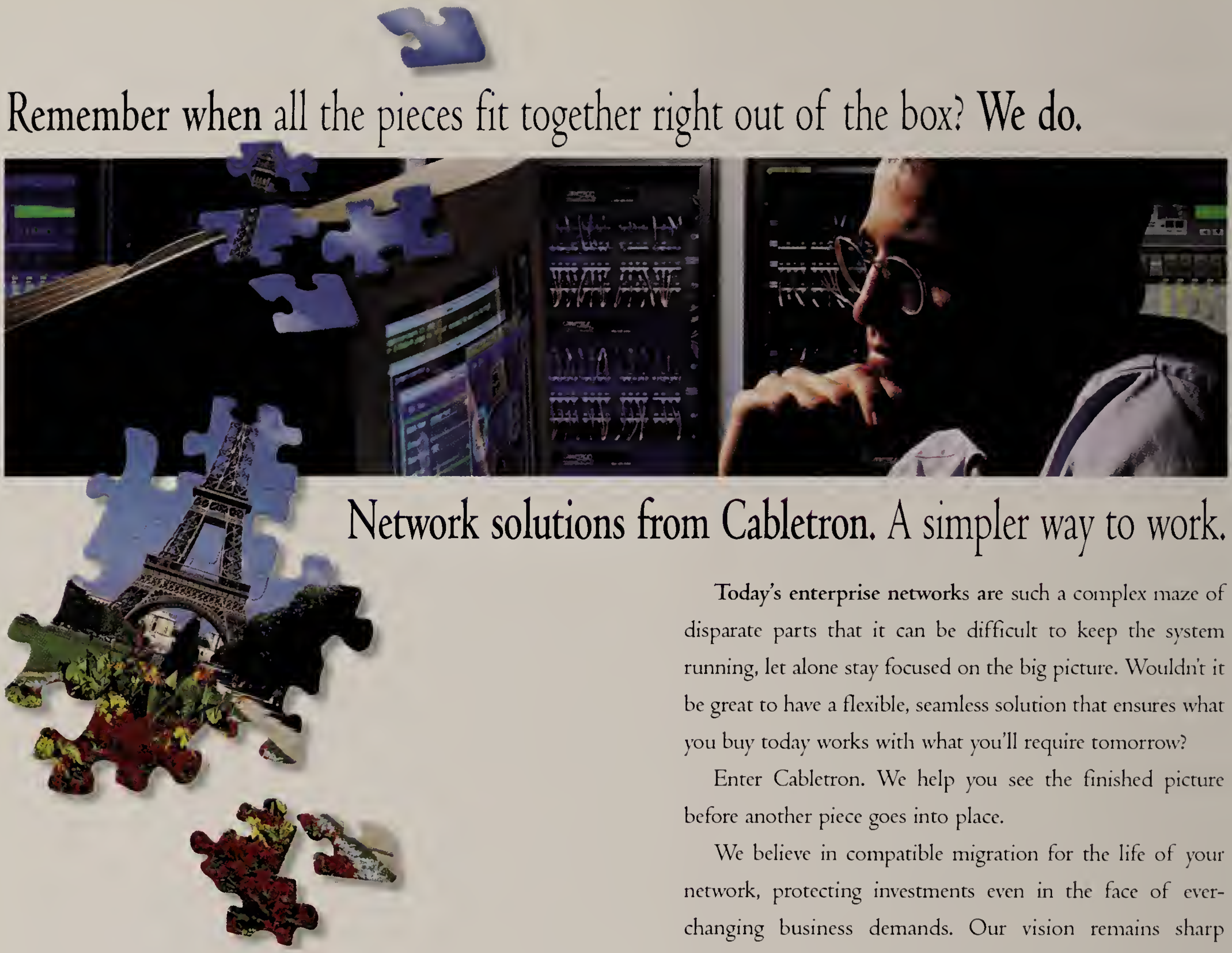

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